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Assessing the contribution of information technology to development: A social systems framework based on structuration theory and autopoiesis

by

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Abstract

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One of the key challenges in information and communication technologies for socio-economic development (ICT4D) is that the contribution of ICT to development is difficult to describe and assess. This is particularly true when looking beyond the immediate context of an ICT4D project, to its impact on the larger social system within which the project is introduced.

This problem can benefit from a systems approach. Systems thinking is concerned with the performance of the total system, when changes are made to a part of the system. Systems thinking recognises that the performance of a subsystem relative to its own goals does not necessarily lead to increased performance of the larger system. However, in the field of ICT4D, systems approaches are seldom used, and appropriate ways to describe and assess a social system are lacking. The study aims to contribute theoretically as well as empirically to the social systems body of knowledge in ICT4D. A particular social systems approach or framework is developed, based on structuration theory and autopoiesis. The framework is attractive because it provides a way to describe and assess the sustainability and state of development of the total system.

The theoretical component of the thesis concerns the development of a social systems framework. This is done in a conceptual study that draws on systems literature and social theory.

The empirical component concerns the application of the systems framework in an ICT4D case study. A descriptive, longitudinal case study is performed in a rural settlement in KwaZulu Natal, South Africa. Data is collected by means of interviews and participant observation during several visits to the settlement. Data analysis is done making use of the concepts in the systems framework. The result of the data analysis is a description of the larger social systems where the ICT4D project is implemented, as systems served, and the ICT4D project, as serving system. By studying the mutual influences between the serving system and systems served, the contribution to socio-economic development of the serving system is assessed.

The study's research contribution is to indicate how a social systems framework can be used to assess an ICT4D project's contribution to the socio-economic development of the social systems it serves.

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Chapter 1 Introduction

1.1 Motivation

As a developing country, South Africa faces severe challenges. On the Human Development Index, it ranks 110 out of 169 countries, a rank that has been dropping during the last five years (UNDP, 2010). Its inequality rate is the second highest in the world, according to the CIA (2011). While urban environments grow and develop, their rural counterparts battle with delivery of the most basic services, such as water, sanitation and access to education (Statistics South Africa, 2001). The official unemployment rate is 25.7% (Statistics South Africa, 2011) while the number that includes people who have given up looking for work is 36.5% (Roos, 2011).

As an Information Systems (IS) professional in South Africa, how does one respond to these challenges? An option that was available to the researcher was to become involved in the area of Information and Communications Technology for socio-economic development (ICT4D). At the Department of Informatics at the University of Pretoria, the ICT4D research stream is concerned with the "ongoing development and scrutiny of various frameworks for facilitating the introduction of ICT to different developing communities for sustainable socio-economic development" (Department of Informatics, 2011). This study is directly concerned with the contribution of ICT to socio-economic development.

1.2 Concise overview of problem

One of the challenges faced by ICT4D is that the contribution of ICT to socio-economic development is difficult to describe and assess. ICT's contribution to less developed countries is often unclear, according to Bollou (2010: 6): "After over a decade of heavy investment in ICT infrastructure expansion in Africa, little empirical research on the contribution of ICT to development has been conducted to assess the impact of these investments on the development of these countries". "We do not know exactly how ICT affects national development" (Sein and Harindranath, 2004: 15). Heeks (2010) indicates that ICT4D impact assessment has to date predominantly focused on ICT4D's immediate impact, such as providing infrastructure, as opposed to the downstream impact on the socio-economic development of the community at large.

A related problematic notion in ICT4D is that of sustainability. The sustainability that is usually aimed for, is the sustainability of the information system implemented (Jacucci et al., 2006), while the researcher regards this as necessary but not sufficient for the increased sustainability or development of the larger social system.

If one could find a way to describe the larger social system in which ICT is introduced, including its mechanisms and dynamics, then one can start to investigate the impact of a new entrant into the system, namely ICT, on the existing mechanisms. This may be possible through a systems approach, which according to Ackoff (1999) is characterised by its concern for the performance of the total system, even where changes are only made to a part of the system. Systems thinking recognises that the performance of a subsystem relative to its own goals does not necessarily lead to increased performance of the larger system. In ICT4D, there is a need to indicate the effect of a technology intervention on the whole, or containing social system.

A literature search of the use of systems thinking in ICT4D returned very few results, with no results from some of the key ICT4D journals. This is despite Walsham et al.'s (1988) early call for dealing with the social context of ICT4D as social systems. In the current ICT4D impact assessment frameworks (Heeks and Molla, 2009) there is no explicit use of systems thinking. These findings are perhaps not surprising in the light of the "surprisingly little systems thinking in the IS discipline" overall (Alter, 2004) and since "the IS community has not come to realise the significance" of systems thinking (Lee, 2004). The literature search on systems thinking in ICT4D indicates that systems work in this field is not only limited but also fragmented, not providing a good base from which to conduct further research.

In the discussion above a need is identified for the use of systems thinking in ICT4D, in particular to describe and assess the impact of an ICT4D project on the sustainability and socio-economic development of its containing social system.

1.3 Research undertaken

1.3.1 Research aims

This research aims at contributing to the systems-related knowledge base of ICT4D, and in particular to contribute a systems approach which can be used to assess ICT4D's contribution to socio-economic development. In the light of the limited and fragmented literature on

systems thinking in ICT4D, this thesis firstly aims to do a broad investigation of social systems approaches that could be used in an ICT4D context to describe the wider social system that affects and is affected by an IS intervention. From the investigation into possible social systems methods, theories or approaches, a particular approach is selected, against criteria specified for the appropriateness of such an approach. The social systems approach is further developed into a systems framework and applied to a case study, in order to assess the usefulness of the systems approach as well as to contribute to the concern stated above, namely to assess the impact of the ICT4D project on the larger social system.

1.3.2 Research strategy

Empirical work conducted in the study constitutes a single, longitudinal case study, performed in an interpretive fashion in a rural village in KwaZulu Natal, South Africa. The Department of Informatics has undertaken an IT literacy training project there since 2009. The community that is involved with and affected by the IT training is described, for purposes of analysis, as two social systems served. The theoretical framework, incorporating Giddens' structuration theory and autopoiesis concepts, is used to describe the two social systems served as well as the ICT4D project, as the serving system. In the process, an in-depth understanding of the social systems as well as their mutual interfaces and influences are developed. This is done to see whether and how the serving system(s) can influence the self-producing ability and sustainability of the systems served. In this manner, the contribution of the ICT4D project to the socio-economic development of the systems served is assessed.

1.3.3 Research contribution

The study makes a theoretical contribution in the area of social systems theory. A search for social systems approaches and theories to apply in an ICT4D setting is documented, resulting in a set of criteria for selecting a social systems theory for the study. The candidate theory, namely social autopoiesis, is further assessed for its feasibility. Following this, the candidate theory is developed into a social systems framework to guide data collection and analysis. The theoretical contribution is presented in Chapters 4 to 7.

The empirical contribution of the study takes the form of a case study in a rural South African village. Using the social systems framework, the social systems involved in an ICT4D project are described, as well as their mutual influences. The result of the empirical study is a description of the contribution of the ICT4D project to the socio-economic development of

the systems served. The empirical study shows that with the help of the theoretical framework, certain claims can be made concerning the value of the ICT4D project to the larger community. The empirical contribution is presented in Chapters 8 and 9.

1.3.4 Research questions

The main research question of this study is as follows:

- How can social systems theory help us to describe and assess the contribution of an IT intervention to the social system it serves, in a remote, rural African community?

The derived research questions are as follows, with the chapters that deal with each in brackets:

- What is an appropriate social systems framework with which to study the impact of an IT intervention in a remote, rural African community? (Chapter 7)
    - How does the literature approach social systems, from systems thinking and from social theory perspectives? (Chapters 4 and 5)
    - What is the value of the theory of autopoiesis when applied socially? (Chapter 6)
- How can a systems framework based on social autopoiesis be practically applied in a deeply rural community in a developing country? (Chapters 8 and 9)

1.4 Chapter outline

The rest of the study is organised as follows:

In Chapter 2, the ICT4D literature of relevance to the research project is discussed. The research problem is described and motivated, followed by a motivation for using systems thinking to address this problem. A literature review of existing systems thinking research in ICT4D is presented and discussed.

Chapter 3 contains the research methodology and planning. The research project entails a theoretical component, namely the search of a social systems theory and the subsequent development of the theory into a framework for practical application. The empirical component entails the application of the systems framework to a case study. The planning of the case study research is presented, along with a concise description of the case study setting,

which is later described in more detail as part of the systems description. In Chapter 3, the research ethics of the study is discussed, as well as the study's limitations.

Chapter 4, the first in the series of theoretical chapters, deals with systems thinking. It provides a historical context and overview of systems thinking, along with key definitions. Following this, a journey through the systems literature and streams of thinking is presented, as part of a search for a systems approach to describe the social context of an ICT4D project.

In Chapter 5, the search for a social systems approach or theory continues, this time traversing through the social theory literature, in particular where systems concepts are applied. Having concluded the journey, the question of selecting a social systems approach or theory is addressed. A set of criteria to aid the selection is presented. Following this, the researcher's preferred theory of social autopoiesis is motivated for by means of the criteria.

Chapter 6 deals with autopoiesis and its social application. Being the suggested social systems theory, the researcher first needs to master its underlying principles and confirm its social applicability before proceeding with its use.

Chapter 7 concludes the series of theoretical chapters. From the suggested theory of social autopoiesis, a systems framework is developed for practical application. This is an important exercise since the literature on the particular conceptualisation of social autopoiesis, that involves the use of structuration theory, provides little guidance as to its practical application.

Chapter 8 is the first of two chapters where the systems framework is practically applied in the ICT4D case study. It contains the preparatory work that, according to the framework, precedes the systems description. The preparatory work consists of a general background description of the rural community, followed by a contextual description of each of the social systems of interest: the systems served as well as the serving system. Also included in the pre-work is the stating of modelling assumptions and simplifications.

Chapter 9 contains the data analysis of the study, in the form of social systems descriptions. The systems are described making use of the derived systems framework. Descriptions are provided of the two social systems served by the ICT4D project, as well as a description of the ICT4D project, being the serving system. Subsequently, the mutual influences of the systems on each other are described. The description of the influences of the systems on each other, in particular of the ICT4D project on its systems served, is used to indicate the

contribution of the ICT4D project to the socio-economic development of the two systems served.

Chapter 10 concludes the study. It contains an assessment of the research process using Klein and Myers' (1999) principles of field research and an assessment of the theoretical contribution using Whetten's (1989) guidelines. It revisits the overall purpose of the study to see if it has been achieved, and suggests opportunities for further research.

Figure 1.1 below provides an overview of the chapter planning, and indicates how the chapters are interrelated.

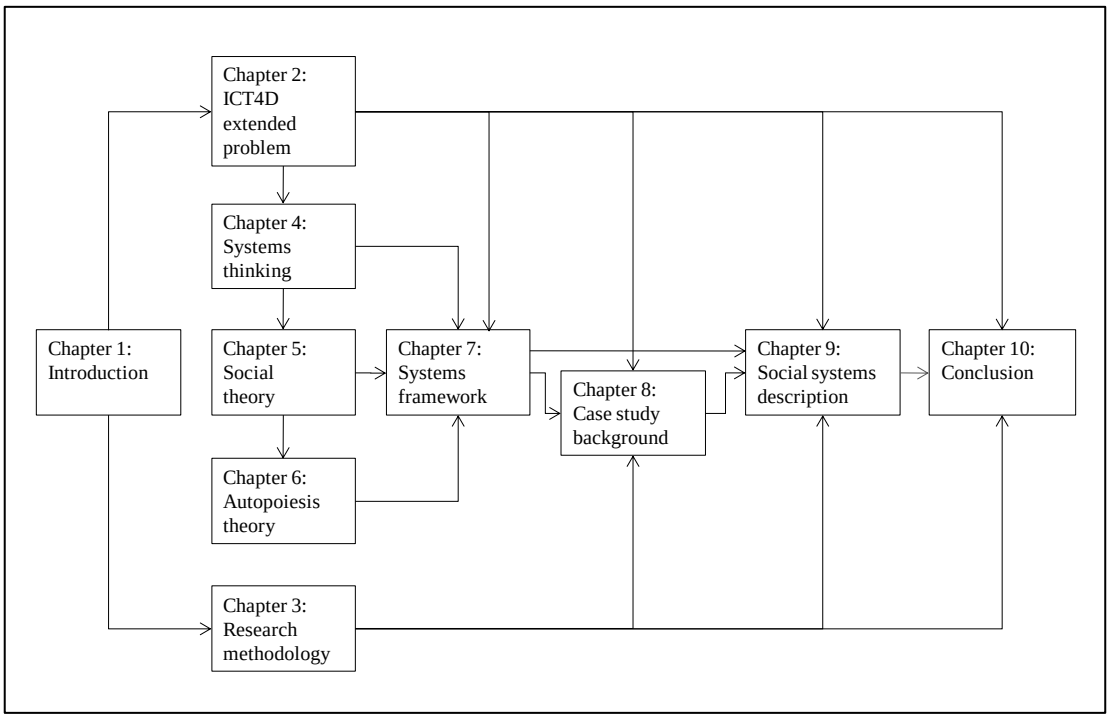

Figure 1.1: Chapter outline

1.5 Conclusion

This study aims to apply systems thinking to study the social context of ICT4D, in order to find a way to describe and assess the contribution of ICT to socio-economic development. The case setting for the empirical study is a remote, rural community in South Africa. The main research question of the study is the following:

- How can social systems theory help us to describe and assess the contribution of an IT intervention to the social system it serves, in a remote, rural African community?

The contribution of the study is twofold. A theoretical contribution is made in the area of social systems methodology. The empirical contribution is in the ICT4D domain, addressing a broader problem in ICT4D while studying a rural South African community. The theoretical framework is applied in the case study.

In Chapter 2 that follows, the ICT4D research context of the study is given, including a more detailed discussion of the problem statement.

Chapter 2 ICT4D background relevant to problem statement

2.1 Introduction

This chapter discusses literature that is relevant background material to the problem statement presented in Chapter 1. It departs by introducing expanded definitions of ICT4D concepts that are relevant to the study. When introducing the concepts of development and sustainability, problems identified in ICT4D with respect to these two notions are discussed. An argument is made for the use of systems thinking to address the identified challenges. Existing contributions on systems thinking in ICT4D are investigated by means of a literature survey. Common themes, weaknesses and opportunities are highlighted. A way forward is suggested for the use of systems thinking to describe the social context of an ICT4D project, with the aim of assessing ICT's contribution to the socio-economic development of the larger social system it serves.

2.2 Key definitions

The following items represent some of the key terminology of the thesis: system, information system, ICT4D, development and sustainability. For each term, a definition and short discussion is provided. The definitions serve as a departure point and also indicate some of the assumptions being made.

2.2.1 System

In this study, a system is regarded as a subjective mental construct, defined according to the purpose of a study or project (based on Checkland, 1999; Olsson and Sjöstedt, 2004; and Daellenbach and McNickle, 2005). Concisely put, a system is "a complex whole the functioning of which depends on its parts and the interactions of those parts." (Jackson, 2003: 3). Systems thinking is characterised by a holistic approach, suited to deal with complex problem environments where an understanding of the relationships between the parts and the whole is important. It is further characterised by its transdisciplinary nature, drawing concepts from one discipline and applying it in another, which can lead to new insights into existing problems (Jackson, 2003: 13).

Supplementary definitions and a broader discussion of the concept of 'system' are provided in Chapter 4, which deals with systems thinking.

2.2.2 Information system

An information system consists of two systems. The first is the system being served, consisting of people that take purposeful action and have information needs. The second is the serving system, which provides support by processing information that assist in the purposeful action of the people in the system served. The nature of the system served, and how this system is understood, must inform what the serving system will look like (Checkland and Holwell, 1998: 111).

Checkland and Holwell's definition is broader than that of Stair and Reynolds (1998: 13), namely "a set of interrelated elements or components that collect (input), manipulate and store (process), and disseminate (output) data and information and provide a feedback mechanism to meet an objective". While Stair and Reynolds (ibid.) focus on the function of information processing only, Checkland and Holwell (1998) add a systems notion, in particular that of the 'system served' and its associated needs. It is further clear that people form the basis of Checkland and Holwell's two systems.

In the above definitions, no mention is made of 'technology' or 'computers'. While it is assumed that computers are usually involved with the information processing function mentioned above, IS professionals distinguish themselves from computer scientists in this respect. "Information systems is 'different' to computing in that the IS professional is concerned not just with the exploitation of technology but with the effects of IT and organisational ramifications that IT will bring" (Stowell and Mingers, 1997: 11). Hirschheim goes as far as stating that "information systems are not technical systems which have behavioural and social consequences, but are social systems which rely to an increasing extent on information technology for their function" (Hirschheim, 1985, cited in Walsham et al., 1988: 191). In this study, the focus will be on the social systems more so than the technology itself. This is because the challenges of an ICT4D project lie with the overall social systems rather than the technology (e.g. Walsham et al., 1988).

2.2.3 Information and communications technology for development (ICT4D)

Information systems in developing countries (ISDC) research is based on the potential contribution of ICT to "the improvement of socio-economic conditions in developing countries" (Avgerou, 2009: 2).

There are two dominant acronyms in the literature: ISDC and ICT4D. Read literally, they differ on two accounts: IS vs. ICT, and developing countries vs. development. According to Brown and Grant (2010), the ICT "for development" and "in developing countries" are in fact two different research streams. However, ISDC and ICT4D are often used in a less strict sense to refer to the same thing. Avgerou's definition above could apply to both. The key concerns of socio-economic development are usually located in developing countries, while IS work in developing countries is not always concerned with socio-economic development. Of the two acronyms, ICT4D appears to be gaining ground. For example, the focus of the International Federation for Information Processing's Work Group 9.4 (IFIP WG 9.4) is on "social implications of computers in developing countries" that bears close relation to ISDC. However, the current IFIP WG 9.4's official web site contains many references to ICT4D in the names of papers, panel discussions and viewpoints of members (IFIP WG 9.4, 2011). This study is primarily concerned with "for development", while simultaneously taking into account the "in a developing country" context. In this study, the term ICT4D will be used, while adhering to the definition of Avgerou (2009) stated above.

The debate on the link between ICT and socio-economic development in ICT4D is discussed under the term 'Development' in Section 2.2.4.

2.2.3.1 ICT4D: a brief history

A brief history of ICT4D is presented as found in Heeks (2008). Heeks attributes the first era of ICT4D to two events of the 1990s: the expansion of the internet and increased interest in international development, as embodied in the Millenium Development Goals. ICT4D's initial main characteristic was the rolling out of telecentre projects. The failure of many of the telecentres drew attention to the typical challenges encountered, namely sustainability, scalability and impact evaluation. The technology associated with the first era of ICT4D was a traditional computer connected to a landline. This setup had very limited potential reach, due to inherent problems with affordability and availability of infrastructure. The current rapid diffusion of mobile telephony with the potential of associated internet access is indicating a

new era for ICT4D, which Heeks (ibid.) terms ICT4D2.0. ICT4D2.0 comes with much opportunity but also with new challenges, such as around availability of relevant applications, services and content, as well as new innovation models. Heeks claims that ICT4D2.0 will require not only inputs from computer scientists and IS professionals, but also that of development studies.

It can be seen that Heeks' (2008) notion of ICT4D is in line with Avgerou's (2009) definition of the contribution of ICT to "the improvement of socio-economic conditions in developing countries."

2.2.3.2 Discourses in ICT4D

ICT4D research can be categorised in different discourses, according to the underlying assumptions on aspects such as development and the processes of innovation and transformation. Avgerou (2008) identifies three general discourses in ICT4D research, which she terms "transfer and diffusion", "social embeddedness" and "transformation". The latter is subsequently divided into "progressive transformation" and "disruptive transformation" (Avgerou, 2009). According to Avgerou (2009), the transfer and diffusion discourse and the social embeddedness discourse represent different sets of assumptions related to ICT innovation. The progressive and disruptive transformation discourses respectively represent different sets of assumptions related to socio-economic development.

In the transfer and diffusion discourse, the value systems, rationality and assumptions with which systems were originally developed, are transferred along with the technology. The focus is on how to adapt these systems to suit local conditions in the developing country. The theoretical origins of the transfer and diffusion discourse are technology diffusion and the technology acceptance model (Avgerou, 2009: 5). The transfer and diffusion discourse holds similarities with Silva and Westrup's (2009) "conventional wisdom" cluster of assumptions, which include the belief in free market drivers for development, first world management practices, change driven by technology, little focus on local context, and using participation as a means of inclusion.

The social embeddedness discourse described by Avgerou (2008) focuses on the local situation and its challenges, and promotes a locally determined process and agenda for developing and/or implementing ICT. The theoretical basis of the social embeddedness

discourse is contemporary social theory, such as structuration theory and Actor Network Theory. These theories are used to investigate the dynamic relationships between and within technology, social actors and the social environment. The sentiments of the social embeddedness discourse is shared in Silva and Westrup's (2009) "emerging understanding" cluster of assumptions, concerned with local, institution level innovations, local adaptation, a socio-technical focus, an inclusive approach and recognition of unique contextual factors.

The two "transformation" discourses discussed by Avgerou (2009) consider the processes of change and development within the developing country setting, and how ICT is implicated in these processes. The progressive transformation stance regards ICT as a benevolent agent of change, and as necessary for socio-economic development within the existing political and social structures in a developing country. In contrast, the disruptive transformation stance takes a more critical approach, often drawing from critical social theory. It questions the agendas for development and of donor agencies. It also attempts to uncover imbalances and power struggles within the local environment. It often takes in a position, siding with the poor or an exploited party.

Using the mentioned categorisations, Avgerou (2009) proceeds to create four paradigms of ICT4D research, as indicated in Figure 2.1. On the one axis is IS innovation, with the transfer and diffusion and social embeddedness as the two possible options. On the other axis is transformation, with progressive transformation and disruptive transformation as the two possible choices. She states that it is normally easy to see whether an ICT4D study follows a transfer and diffusion or a social embeddedness approach to IS innovation. However, since development assumptions are often not made explicit, the transformation position is often not clear. She believes ICT4D research can benefit from an increased awareness of development assumptions, and an increased use of development theories. In Chapter 3, the ICT4D research approach of this study will be located within Avgerou's four paradigms.

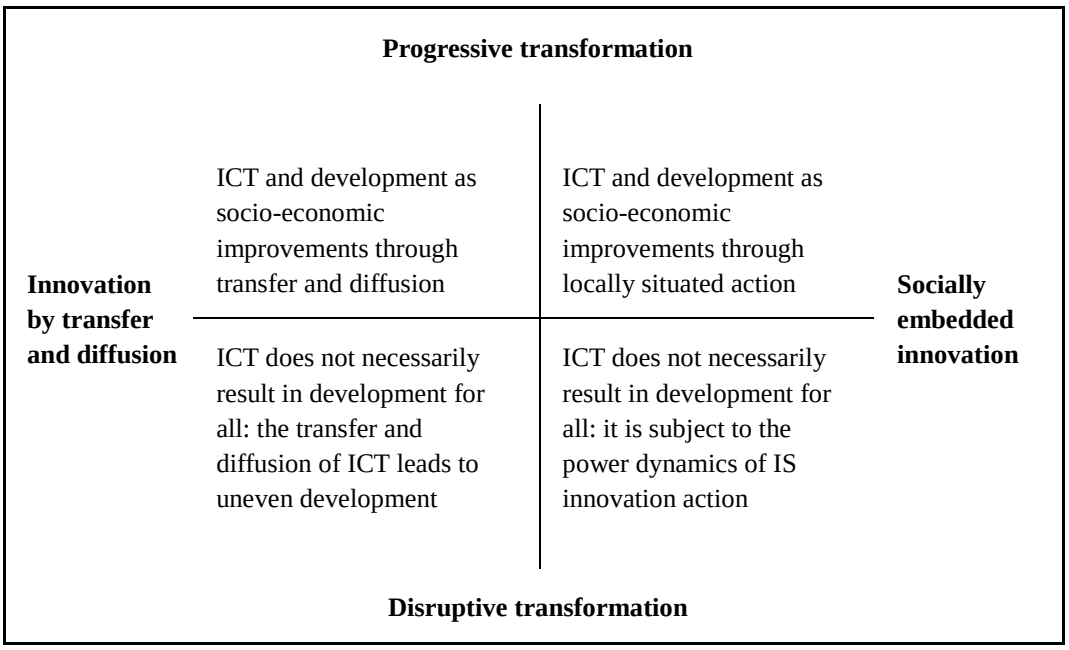

Figure 2.1: Four paradigms of ICT4D research
(Avgerou, 2009: 21)

2.2.4 Development

'Development' is the aim of ICT4D. However, most ICT4D studies do not interrogate what is meant with development, possibly to avoid controversy (Avgerou, 2009). Avgerou (2009: 2) refers to "the improvement of socio-economic conditions", and "the realisation of perceptions of desirable world orders", with criteria such as the Millenium Development Goals. Apart from Avgerou (ibid.) there are some leading ICT4D scholars who also pay attention to the matter of development. Among them, there is broad consensus that development should be defined in more than economic terms (Walsham, 2005; Sein and Harindranath, 2004; Qureshi, 2005; Roode et al., 2004; Silva and Westrup, 2009). "The certainties of a market-based framework of development and the scope of a managerial set of recipes for development are being cast into question" (Silva and Westrup, 2009: 60). Some authors extend the traditional economic view by including factors pertaining to social development (Qureshi, 2005). Other authors call for a focus on human level development (Sein and Harindranath, 2004; Roode et al., 2004), an alternative notion rather than a linear extension of the economic view. Roode et al. (ibid.) use the work of Todaro (1997) and Max-Neef et al. (1991) that promote human-centred notions of development. For example, Max-Neef et al. (ibid.) advocate development towards self-reliance, where self-reliance does not mean isolated self-sufficiency, but includes horizontal interdependence and vertical integration. This leads Roode et al. (ibid.) to state that

sustainable development is achieved though self-reliant human scale development. This thinking is in line with Hettne's (1990: 153) definition of "another development", which is about meeting human needs in a way that is endogenous, self-reliant and ecologically sound.

Development theorists whose views are at times promoted and used in ICT4D, usually as alternatives to the narrow economic view, include Todaro and Max-Neef (Roode et al., 2004), Sen's capability theory (Alexander and Phahlamohlaka, 2006; Walsham and Sahay, 2006; Silva and Westrup, 2009; Avgerou, 2009; Zheng, 2009; Thapa and Sæbø, 2011) as well as the more radical ideas of Escobar (Walsham, 2005; Avgerou, 2000; Silva and Westrup, 2009). The development theorist Hettne's work is used by Mursu et al. (2004).

This study will rely on the definitions of 'development' by Avgerou (2009: 2), namely "the improvement of socio-economic conditions" as well as Roode et al.'s (2004: 4) notion of "self-reliant human scale development which flows from the individual level to the local, regional and national levels, and which is horizontally interdependent and vertical complementary".

2.2.4.1 The problematic relation between ICT and development

According to Bollou (2010), one of the challenges faced by ICT4D is that the contribution of ICT to development is often unclear, in particular in less developed countries. He investigates the impact on development of ICT infrastructure expansion in six West African countries, and concludes that these projects did not show a positive effect on a number of development indicators, such as productivity and the Human Development Index (HDI).

Other researchers concerned with the problematic relation between ICT and development include Avgerou (2003), Sein and Harindranath (2004), Qureshi (2005) and Heeks (2010). Avgerou (2003) questions the optimistic generalisation made by international development agencies such as the World Bank and UNDP, namely that ICT is an instrument that leads to development. She shows that the instrumentalist view is underpinned by assumptions of neo-classical economic theory, while the conditions for economic actors in developing countries differ vastly from those in first world countries. Avgerou's (ibid.) arguments indicate that it cannot be assumed that ICT will necessarily lead to development. Qureshi (2005) and Sein and Harindranath (2004) address the question of how ICT affects development. According to Sein and Harindranath (2004: 15), "we do not know exactly how ICT affects national

development." They suggest that one first needs to address the question of how development takes place, secondly assess how the development process can be positively influenced, and then attempt to indicate the effect of ICT on the development process. Qureshi (2005) investigates a number of historical ICT4D case studies to derive a process model of how ICT could lead to development. Although some of these cases show evidence of outcomes that could be linked to development, in many cases the development impact is only suggested. Qureshi (2005) as well as Sein and Harindranath's (2004) work imply that the impact of ICT on development can only be indirectly assessed. Heeks (2010) argues for more research on ICT's *downstream* impact on development, such as its impact on sustainable livelihoods and enhancing of capabilities. According to Heeks (ibid.), the effort to date in ICT4D impact assessment has been on indicating its upstream impact, such as on providing infrastructure and accessibility. Accordingly, he calls for "more theory-based evidence about ICT's impact on development" (Heeks 2010: 635).

2.2.5 Sustainability

'Sustainable development' is defined in the 1987 Brundtland report as "development that meets the need of the present without compromising the ability of future generations to meet their own needs" (Scott and Marshall, 2005). This definition is specifically concerned with environmental sustainability.

According to the Oxford Dictionary, the meaning of 'sustain' includes among other to support, give strength to, endure, maintain or keep (Concise Oxford Dictionary, 1990).

In the IS context, sustainability refers to "addressing challenges in the design and implementation of IT solutions" in order for these to endure or to continue being operational in their environment of implementation (Jacucci et al., 2006). This definition can be associated with a technocentric approach, since sustainability is only used in reference to the IT solution implemented, i.e. it is about the sustainability of the technology intervention. The use of the term sustainability with reference to the information system itself, is widely encountered in ICT4D, e.g. Kimaro and Nhampossa (2005), Bailey (2009) and Hosman (2011). Ali and Bailur (2007) provide a more comprehensive view, which covers five types of sustainability: financial, technological, social, institutional, and to a lesser degree, environmental (Ali and Bailur, 2007). According to Ali and Bailur, financial and technological sustainability are purely concerned with the ability of the project to continue, given its own

financial and technological requirements, the two of which are interdependent. Social sustainability concerns the social acceptability of the project among the local community, and likewise institutional sustainability is about acceptability among institutional actors. Environmental sustainability is seldom addressed (Ali and Bailur, ibid.). Among the mentioned types of sustainability, the social dimension appears to be the only one where the needs of the larger community are sometimes included as part of the sustainability discourse. As an example, Mursu et al. (2004) take into account the demand for the technology as well as its appropriateness in the particular context, as prerequisites for sustainability. According to Pellegrini (1980, cited in Mursu et al., 2004), "technology should be considered 'appropriate' when its introduction into a community creates a self-reinforcing process internal to the same community, which supports the growth of the local activities and the development of indigenous capabilities as decided by the community itself." Similarly, Roode et al.'s (2004) definition of development in an ICT4D context includes the term self-reliance, which is about sustainability at the level of the encompassing social system.

To conclude: 'sustainability' in ICT4D usually refers to the ability to sustain an IS project that is developed and implemented in an ICT4D context. This study will however take the view that the sustainability of primary concern is that of the larger social system to which the ICT4D project should contribute; its own sustainability being a necessary but not sufficient condition for increased sustainability of the encompassing social system.

2.3 Dealing with development and sustainability in an alternative way: introducing systems thinking

If broader definitions of development and sustainability are adopted, such as those respectively proposed by Roode et al. (2004) and Ali and Bailur (2007), then it follows that the sustainability of the technology or system introduced in an ICT4D context, is a necessary but not sufficient condition for the increased sustainability of the larger social system, and for achieving self-reliant human-scale development. What does it help if the technology is successfully introduced, and one cannot show the downstream impact on development, whether with economic, productivity or HDI indicators? Further, how can one assess whether self-reliant human scale development is achieved?

It appears that some description of the larger social system in which ICT is introduced, is required – the system served, in Checkland's (1999a) terms. If the mechanisms, dynamics or

influences of the larger societal system can be sufficiently described, then one can start to investigate the impact of a new introduction into the system, namely ICT, on the existing mechanisms. This may be possible through a systems approach, which according to Ackoff (1999) is characterised by its *concern for the performance of the total system, even where changes are only made to a part of the system*. Systems thinking recognises that the performance of a subsystem relative to its own goals does not necessarily lead to increased performance of the larger system.

The general argument for systems thinking can be found in e.g. Jackson (2003) and Daellenbach and McNickle (2005). These authors argue the benefits of a holistic approach that provides a means to deal with the relationships between system elements, system processes and their effect on the system as a whole. A systems approach can help to identify and manage emergent behaviour. This is something required in ICT4D: to be able to show the effect of a technology intervention on the whole, or containing social system.

Heeks and Molla's (2009) ICT4D impact assessment compendium provides an overview of the prevailing views and thinking on impact assessment (IA) in ICT4D. Among the IA frameworks that are compatible with the development views stated earlier, is a capabilities framework based on the work of Sen, which according to Heeks and Molla (ibid.) is provisional and requires further work to develop, a livelihoods framework that is well developed but with limited links to ICT, as well as a cultural-institutional framework which focuses on the 'soft' issues related to ICT impact. However, there appears to be no framework that explicitly makes use of systems thinking.

2.4 Systems thinking in IS and ICT4D

How is systems thinking usually applied in the IS discipline, to assist in dealing with a social system? Some systems-related research and methods are available, such as Checkland's (1999) Soft Systems Methodology (SSM) and Mumford's (2000) sociotechnical approach. In addition to these, Alter (2004) mentions Actor Network Theory and Kling and Scacchi's web of computing as approaches in IS that are to some extent based on systems thinking.

However, according to Alter (2004), there is "surprisingly limited systems thinking in the IS discipline", which motivated his paper titled "Desperately seeking systems thinking in the IS discipline". Mingers and White (2010) confirm that although most IS researchers view

themselves as systems thinkers, very few of them are actually using systems theory. Lee (2004) states that IS studies seldom have a systems focus, but instead tend to view 'information systems' to be the same as 'information technology'. With some exceptions such as the work of Checkland and Holwell, "the IS research community has not come to realise the significance" of systems thinking (Lee 2004: 14). This is particularly true of ICT4D, where in dedicated ICT4D publications, searches for systems-related work return few or no results, as indicated in Table 2.1 below.

The publication titles in Table 2.1 are regarded to represent ICT4D thinking, while they are not the exclusive publication outlets for ICT4D research. Three international ICT4D journals have been searched, namely *Information Technology for Development*, *Information Technologies and International Development*, and *The Electronic Journal on Information Systems in Developing Countries (EJISDC)*. In addition, IFIP WG 9.4 Conference Proceedings were searched. Avgerou's (2009) ICT4D research review makes use of the same titles, but longer publication periods. The publication periods for this exercise were determined by what was available to the researcher as full-text electronic documents, since full-text searches were performed for all the systems phrases indicated in Table 2.1. In this manner, *Information Technologies and International Development* and *EJISDC* were searched for their entire publication history, while the last thirteen years of *Information Technology for Development*'s papers were included in the search. Proceedings with full papers were electronically available for only the two most recent IFIP WG 9.4 Conference Proceedings, namely 2009 and 2011. The latter search was appended with an archive search on IFIP WG9.4 Proceedings since 2002, through conference abstracts. Nepal and Petkov's (2002) paper was sourced in this manner. Seven papers were found in total.

Publication title	**Period searched**	**Search terms (full text)**	**Returns**[1]
Information Technology for Development	Vol 8(1) 1998 –Vol 17(2) 2011	"systems thinking" OR "systems theory" OR "systems approach" OR "systems method"	None
Information Technologies and International Development	Vol 1(1) 2003 – Vol 7(2) 2011		None
Electronic Journal of Information Systems in Developing Countries (EJISDC)	Vol 1 (2000) – Vol 47 (2011)		Corea (2000) Huy et al. (2004) Gunawardena and Brown (2007)
IFIP WG 9.4 Conference Proceedings[2]	2002 - 2011		Nepal and Petkov (2002) Turpin et al. (2009) Nicholson and Babin (2011) Twinomurinzi and Ghartey-Tagoe (2011)

Table 2.1: Searches for systems-related work in ICT4D publications

Walsham et al. (1988) made a call more than two decades ago for viewing information systems as social systems in ICT4D, and in particular to use interpretive systems approaches to deal with ICT4D's social context. It appears from Table 2.1 that this call was not well heeded. Walsham (2011), while reflecting back on the mentioned call, claims that it is still relevant and stresses the need for theory development in ICT4D, in particular pertaining to the social context.

2.4.1 Themes in systems-related ICT4D publications

To the seven papers listed in Table 2.1, Walsham et al.'s (1988) earlier paper is added, being a significant contribution even though sourced separately. The eight papers are scrutinised below for their respective views on systems, and the systems approaches used or advocated.

[1] Excludes papers where reference to a search term was incidental.
[2] In the IFIP WG9.4 internet archives, abstracts are available for the 2002 and 2005 conferences, selected papers for 2007 and full papers for the 2009 and 2011 conferences.

An overview of each paper is given, ordered chronologically. The papers are quite diverse in philosophy and content, and the reader is warned that the overviews below do not form coherent reading. The papers' systems views and systems approaches are summarised in Table 2.2.

The first paper discussed is Walsham et al. (1998). The authors argue for an information system to be regarded as a social system, where human, organisational and technical factors all influence its development and implementation. Since ICT4D involves implementing information systems in a context with extraordinary challenges around social, political, cultural and infrastructural factors, to name a few, a broader conceptualisation which take these factors into account becomes all the more important. According to Walsham et al. (ibid.), if this broader conceptualisation is done in a formal-rational manner by modelling organisational and human factors as part of a bigger 'machine', the exercise will not be helpful. Rather, social systems need to be studied interpretively, in a way that incorporates the meanings that the humans in the system attach to their actions. As an example of an interpretive social systems approach, Walsham et al. (ibid.) refer to an approach that they applied, based on Checkland's (1981) SSM and Kling's web models (Kling and Scacchi, 1982, cited in Walsham et al., 1988). SSM provided the authors with a way to surface the world views and conflicting perspectives of role-players. The web models helped to describe a system as an ensemble of objects with requirements, capabilities, social interests and constraints, which include equipment as well as humans in the same web. This approach has been applied in a western setting, but Walsham et al. (ibid.) argue that the characteristics it exemplifies are suited to the conditions in developing countries. Walsham's (ibid.) paper makes the point that information systems in developing countries are multifated social systems that can benefit from interpretive social systems approaches.

Paper	Systems view	Approach promoted
Walsham et al. (1988)	IS, especially in developing countries, is a multifaceted social system requiring interpretive approach.	SSM with web of computing
Corea (2000)	Society as social system. Its behaviour drives innovation which drives development Development = social process, technological innovation = technical process. However, socio and techno to be viewed as part of same system.	STS (modern Dutch variant)
Nepal and Petkov (2002)	Telecommunications project evaluation in rural areas to recognise Habermas' three worlds (material, social and personal). Critical systems thinking / multimethodology is required to address these worlds, in interpretive fashion.	Systems framework based on Total Systems Intervention (TSI) Pluralist: SSM and AHP are main components
Huy et al. (2004)	Integration is required among courses in an MIS curriculum; a systems approach can facilitate interdisciplinarity.	Heckhausen's six level framework towards interdisciplinarity
Gunawardena and Brown (2007)	Project management in developing countries is a messy, complex social system.	SSM
Turpin et al. (2009)[3]	The social context of IS in developing countries is a messy system that can benefit from the Multiple Perspectives Approach, recognising technical, personal, organisational, ethical and aesthetical views on same situation.	Pluralist: Multiple Perspectives Approach, combining rational, interpretive and critical methods
Nicholson and Babin (2011)	Global IT outsourcing is a complex multi-system, with multiple stakeholders, differing viewpoints and unintended consequences.	SSM combined with philantrocapitalist and development models
Twinomurinzi and Ghartey-Tagoe (2011)	E-government that can counter corruption in developing countries is a system that requires proper work processes.	Work system method

Table 2.2: Systems views and approaches found in systems-related ICT4D papers

[3] This paper does not bear relation to the core of this study.

Corea (2000) belongs to the school of thinking that technological innovation is the most important driver of economic development. He proposes that development has to happen from within. This needs to be done by creating an environment that is conducive to technological innovation. Technological innovation is characterised by behaviour that seeks continuous improvement and irreversible change. According to Corea (ibid.), this behaviour distinguishes prosperous, fast-changing societies from stagnant, poorer ones. In order to achieve economic development, the systems design of societies needs to be revisited. A systems approach is required that incorporates the technical process of technological innovation as well as the social process of development. Sociotechnical systems (STS) theory recognises both human and technical dimensions. Corea (ibid.) recommends the modern Dutch variant of STS that regards technology as human expression, rather than separating the social and the technical. Corea concludes that such an approach is conceptually suited to the design of a social system with technologically innovative behaviour that is development-oriented. Corea's (ibid.) paper argues that economic development of societies need to be addressed by revisiting the societal systems design, recognising human as well as technical dimensions.

Nepal and Petkov (2002) recognise the complex and messy nature of evaluating telecommunications infrastructure in rural areas, containing technical, social, cultural as well as political aspects. They want to describe the multifaceted rural communications system and its impact on local socio-economic development. They argue that no single methodology exists that can account for the complexity of the system. They propose Critical Systems Thinking (e.g. Flood and Jackson, 1991) as their theoretical foundation, since it acknowledges all of Habermas' three interests, namely the technical, practical and emancipatory. This theoretical foundation, in promoting multiple perspectives, is consistent with a pluralist approach. Nepal and Petkov (ibid.) categorise the multiple views as material, personal and social, again in line with Habermas' three worlds. For each of the views, suited methodologies or parts of methodologies are suggested. Nepal and Petkov present their systems framework as a process which at its evaluation phase uses multiple methods. The methods relied on most strongly are SSM and the Analytical Hierarchy Process (AHP). To demonstrate its application, a case is discussed where the systems framework is applied in rural KwaZulu Natal, South Africa. Nepal and Petkov used the framework while acting as consultants to the national public network service provider. This makes Nepal and Petkov's study one of the very few where a systems framework is both designed and applied in collaboration with stakeholders within an ICT4D context, so as to assess its practical value. Nepal and Petkov's

paper addresses the complex problem of evaluating rural communications infrastructure by means of a pluralist systems approach, incorporating multiple philosophical paradigms.

Huy et al. (2004) discuss the use of a systems approach to develop an interdisciplinary MIS curriculum at a Vietnamese university. According to the authors, the set of skills required from MIS professionals include business knowledge, communication and team skills, analytical and critical thinking skills, as well as technological expertise. MIS is an interdisciplinary field, but MIS curricula lack a framework to facilitate discipline integration. They propose Heckhausen's (1972, cited in Huy et al., 2004) framework, which they regard as a systems framework, to facilitate integration. The framework has six levels, ranging from teaching multiple topics with no integration at level one, to a unifying or truly interdisciplinary approach at level six. Strategies are provided to assist with moving from one level in the framework to the next. According to Huy et al. (ibid.) the interdisciplinary integration levels of MIS courses in Vietnam, a developing country, are very low. Rather than copying established integrated MIS programmes from developed countries, they propose that Vietnamese institutions move up Heckhausen's framework by themselves, one level at a time, thereby ensuring that the curricula remain relevant to Vietnam and its needs. They discuss a practical application-in-progress of the proposed approach at a university in Vietnam. Their overall impression is that moving towards interdisciplinarity is a "complex, socio-technical process which influences and is influenced by other institutional arrangements" (Huy et al., 2004: 11). To conclude, Huy et al. (ibid.) recognise and attempt to address systemic issues around an MIS curriculum in a developing country. Unfortunately, their reference to Heckhausen's framework as a systems approach is not substantiated.

Gunawardena and Brown (2007) investigate a number of donor agency funded projects in the Vocational and Technical Education (VTE) sector in developing Asian countries. The countries covered in their study are Laos, Sri Lanka and Vietnam. One of the problems identified in IS related donor projects in this context, is project management. The authors show that the project management challenges that are identified all relate to the complex, multifaceted social nature of the application environment in developing countries. Traditional 'hard systems' project management approaches are not well suited to deal with these situations, and the authors argue for the use of soft systems approaches. In particular, the authors advocate the use of SSM. To suit the particular context, an SSM based methodology is drafted and used on nine case studies, three in each Asian country studied. The analysts applying the methodology are the researchers, and the participants are expert representatives

from the stakeholder groups identified in each case. The SSM process involves the development of root definitions and conceptual models, and result in the reporting of suggested changes. The problems identified during the analysis are predominantly 'soft' issues, such as collaboration between key role-players. According to the authors, the identified problem areas confirm the necessity of a softer approach to IS project management in such a complex project environment in a developing country. They indicate the value of a soft systems methodology in dealing with this complex project environment.

Turpin et al. (2009) argue that the social context of IS in developing countries have the attributes of a messy system. Messy systems cannot be addressed by traditional systems approaches. The authors argue for the use of Mitroff and Linstone's (1993) Multiple Perspectives Approach (MPA) in a messy environment. The MPA assists in developing technical, organisational, personal, ethical and aesthetic views on a situation, making use of three sociological paradigms in the process. Two cases of the successful application of the MPA by the authors are presented, both considering the messy social issues within a developing country. In the one study, the MPA was used to analyse a national poverty alleviation programme in South Africa. The second was a teaching case, where graduate students had to use the MPA to investigate the xenophobia crisis experienced in South Africa in 2008. The authors conclude by recommending the MPA to ICT4D researchers, since the rich and balanced set of perspectives it assists in generating, can be used to describe and analyse better the messy social systems in a developing country.

Nicholson and Babin (2011) critically examine the social responsibility claims made by global IT outsourcing (GITO) companies. Their case study focuses on the French GITO company Steria, who sponsors Indian schools in areas where outsourcing centres are located. Sponsorship involves the establishment of a computer centre, IT training as well as addressing other possible infrastructural and mentoring needs, depending on the school. The schools project is analysed using Porter and Kramer's (2006, cited in Nicholson and Babin, 2011) framework for philantrocapitalism, from where it emerges as a clear win-win programme with benefits in terms of business as well as development. Nicholson and Babin (ibid.) are not comfortable with the optimistic conclusions from Porter and Kramer's framework, which are weighted heavily in favour of Steria's own interests. They argue that Checkland's soft systems analysis would be more suited to investigate the complex situation, with its multiple interrelated systems of interest, multiple actors and viewpoints, and unexpected consequences within the wider system. Nicholson and Babin show that all their points of criticism of the

Porter and Kramer framework are accommodated by Checkland's soft systems approach. They propose the joint use of the mentioned two approaches for future research on philantrocapitalism. Nicholson and Babin's (ibid.) paper indicate that global IT outsourcing is a complex multi-system, and hence a framework for philantrocapitalism should include soft systems thinking.

Twinomurinzi and Ghartey-Tagoe (2011) investigate the role of IS to address corruption in developing countries. Effective e-government is viewed as a means to counter government corruption. The authors study a number of historical success stories on e-government implementation in developing countries to find common underlying principles. As a case study, they investigate South Africa's state of e-government implementation, in particular where it concerns anti-corruption measures. One of the largest hindrances to e-government implementation in South Africa is found to be the lack of explicit and detailed work processes in government departments. To this end, the authors recommend the use of Alter's (2004) work system method. The authors did not use a systems method in their own research, but indicated how the attributes of the work system method would be able to address the concerns in the case they investigated. As with Nicholson and Babin (2011), a systems method is used as a way to critique an existing approach in ICT4D and to suggest improvements. To conclude, Twinomurinzi and Ghartey-Tagoe's (ibid.) paper views e-government in South Africa as a system that requires proper work processes, and that can benefit from a systems method to improve these processes.

In the summary presented in Table 2.2, the papers in which systems thinking plays a central role have been shaded. Of the eight papers discussed, systems thinking only plays a central role in five.

2.4.2 Assessment of ICT4D systems approaches

From the above discussions, a fragmentedness in the application of systems concepts is clear. Among the five papers identified where systems thinking play a central role, the following common themes are found:

The multifaceted nature of the problem situation in ICT4D, presenting challenges that are not only technical but also include cultural, political, infrastructural and regulatory concerns, are mentioned repeatedly (Walsham et al., 1988; Petkov et al., 2002; Gunawardena and Brown,

2007). These papers subsequently argue that the nature of the problem calls for a (soft) systems approach; one that can encompass much more than the technical system.

The phrase 'multiple perspectives' commonly appears as a means to address the multifaceted problem situation. 'Multiple perspectives' can refer to different views on paradigm level, such as 'technical' and 'emancipatory' (Petkov et al., 2002), or to different perspectives from different individuals (Walsham et al., 1988). At the very least, the different individual views call for an interpretive approach. If taken further, the different angles on the matter call for a pluralist or even a multi-paradigmatic approach.

When advocating particular systems methodologies to use, pluralist approaches are common. Among the methods advocated are soft systems methodologies (mainly SSM) and critical systems thinking, as well as approaches that can accommodate both social and technical aspects of a problem, such as STS and Kling's web models.

In papers that discuss practical case studies, the selected systems approach leads to a description and analysis/evaluation, which may be followed by recommendations (e.g. Petkov et al., 2002; Gunawardena and Brown, 2007; Turpin et al., 2009). Some work is at theoretical or conceptual level (Corea 2000), or proposes the use of certain methodologies (Walsham et al., 1988). In two papers where systems thinking does not play a central role (Nicholson and Babin, 2011; Twinomurinzi and Ghartey-Tagoe, 2011), a systems approach is suggested as an improved way of dealing with problems identified on the respective case studies.

As can be seen in the discussion above, based on publications that are regarded to represent ICT4D thinking, the use of systems thinking in ICT4D is limited and fragmented. A good portion of the papers refer to systems approaches that they do not apply themselves. The papers analysed show some common themes, although these papers do not provide a strong foundation on systems thinking in ICT4D, on which to base further work. If the conclusions from the above analysis are considered together with arguments for the use of systems thinking in ICT4D, it indicates a need for further work in this area. To confirm this need, the arguments presented for using systems thinking in ICT4D are revisited.

2.4.3 Revisiting the arguments for using systems thinking in ICT4D

The following three arguments for the use of systems thinking in ICT4D have been presented in this chapter:

Firstly, in order to deal with the problem of assessing the contribution of an ICT4D project to the larger social system in which it is introduced, a systems approach was suggested. A systems approach is concerned with the performance of the total system when changes are made to a part of the system, and it recognises that good performance at the level of a subsystem does not necessarily translate into increased performance of the larger system (Ackoff, 1999).

Second, ICT4D's social context provides extraordinary challenges related to social, political, cultural and infrastructural factors (Walsham et al., 1988; Petkov et al., 2002; Gunawardena and Brown, 2007). The benefits of systems thinking include its ability to deal with complex situations and its transdisciplinarity (Jackson, 2003). Hence, a systems approach by its nature has the potential to deal with the social context of an ICT4D project.

Thirdly, within the broader IS field, the limited use of systems thinking is lamented by a number of its prominent scholars. Alter (2004) notes the surprisingly limited systems thinking in the IS discipline. Mingers and White (2010) state that although IS researchers generally regard themselves as systems thinkers, they are not actually using systems theory. Lee (2004) states that IS studies tend to view 'information systems' to be the same as 'information technology', and that the IS research community in general does not realise the significance of systems thinking. Lee (2010) comes to a conclusion similar to that of Mingers and White (ibid.), namely that the IS discipline claims to be a systems discipline while in practice it is not. Lee (2010) suggests that systems thinking should be put back into IS, to do justice to the name 'information *systems*'.

If systems thinking is undervalued in IS in general, and the complex, multi-dimensional problem situation in ICT4D calls for a systems approach even more than traditional IS research, why is systems thinking in ICT4D almost nonexistent? Is it perhaps too difficult or challenging? Are ICT4D researchers not sufficiently aware or convinced of its potential benefits? Can it really deliver the benefits it promises? Since there is so little empirical work on systems thinking in ICT4D from which to draw conclusions, an opportunity exists for

systems work in ICT4D, to ascertain whether any of the mentioned concerns are founded, and if not, to refute the concerns.

2.4.4 The way forward: searching for a social systems description

An argument has been presented for the use of systems thinking in ICT4D overall, and in particular for assessing the developmental contribution of ICT to the larger social system it serves. The next challenge is to find a suitable systems approach to do this.

In the light of the limited and fragmented literature on systems thinking in ICT4D, this thesis departs with a broad investigation of social systems approaches that could be used in an ICT4D context to describe the wider social system that affects and is affected by an IS intervention. The investigation attempts to find approaches that focus on the 'social' as well as the 'system' aspects of a social system. According to Checkland, who assumes a key role in the existing systems-related ICT4D literature, a social system has characteristics of a natural system as well as a human activity system (Checkland, 1999; see section 4.5.1), meaning that both sets of characteristics need to be recognised in a social systems approach.

The systems literature is firstly studied to see how systems theorists approach social systems. Since systems theories or approaches predominantly have biological and technical origins, they might not take the system's social nature sufficiently into account. Hence, the study also investigates the use of systems concepts in social theory, for possible useful social systems conceptions where the social domain is well captured.

From the literature survey on social systems methods, theories or approaches, a particular approach is derived or selected, using criteria specified for the appropriateness of such an approach. This social systems approach is developed further and applied to a case study, in order to assess the usefulness of the systems approach as well as to contribute to the concern stated above, namely to assess the contribution of the ICT4D project to the larger social system.

2.5 Conclusion

In this chapter, problems related to the notions of development and sustainability in ICT4D are discussed. A challenge noted in the existing literature is the difficulty of describing and assessing ICT's contribution to the socio-economic development of the larger social system it serves. The researcher identifies a related challenge, namely that sustainability is usually only assessed at project level rather than at the level of the community where an ICT4D project is initiated. The researcher then argues that systems thinking can help with describing the larger social context within which ICT4D takes place, so as to investigate the impact of a change at subsystem level on the development and sustainability of the larger social system of concern. A review of current literature on systems thinking in ICT4D shows that such literature is limited and fragmented, leaving an opportunity to contribute to this domain. In particular, there is no previous work using systems thinking that focuses on the impact on development and sustainability of the encompassing social system. A way forward is suggested, starting with a search for a suitable social systems approach.

Before commencing with this search, the study's research philosophy and strategy needs to be considered. This is done in Chapter 3, where a research methodology is presented to support the research aims discussed here and in Chapter 1.

Chapter 3 Research methodology

3.1 Introduction

This chapter discusses the research philosophy and strategy of the study. A number of contexts need to be taken into account when considering the research methodology: the IS and ICT4D research landscapes, the study's overall research aims, the practicalities presented by a case study context and the conceptual fit of the theoretical framework. Guidance needs to be provided for executing the study, not only concerning the way of thinking but also to guide data collection and analysis.

The chapter commences with a discussion of the general assumptions underlying research philosophy. Burrell and Morgan's (1979) research paradigms are introduced and critically reviewed before a position is taken on the research philosophy and paradigm for this study. The IS and ICT4D research landscapes are briefly assessed to consider this study's research position within the landscape. The research planning for conducting a case study is presented, including aspects such as the type of study, time frame, the use of theory as well as data collection, analysis and dissemination. The case setting is subsequently presented. The chapter concludes by stating ethical concerns, the limitations of the study and its contribution to knowledge.

3.2 Research philosophy

In this section, the different possible assumptions concerning ontology, epistemology, human nature and regulation vs. change are discussed. These assumptions are used to distinguish between research paradigms. The different paradigms for studying social systems, as presented by Burrell and Morgan (1979), are discussed. After taking into account some of the problems encountered with the paradigmatic division, a research philosophy for this study is suggested.

3.2.1 The subjective-objective dimension

Burrell and Morgan (1979: 1) present three sets of assumptions which they associate with the *nature* of social science. According to them, the extremes of each assumption belong with either a subjective or objective research orientation. The assumptions relate to ontology, epistemology and human nature.

3.2.1.1 Ontology

Ontology concerns the *nature of the world* that is investigated, in this case the social world (Burrell and Morgan, 1979: 1). Does the social world have an existence independent of the observer, or is it the mental product of the observer? Burrell and Morgan (1979: 4) distinguish between two ontological positions, namely realism and nominalism. The *realist* position assumes that the social world has a reality of its own. Social structures have an independent existence, no matter how we refer to them or whether we even know about them. According to the contrasting view of *nominalism*, the social world only exists in the names and labels we attach to it. We use these names and concepts as part of our sense-making and to help us interact with the social world.

3.2.1.2 Epistemology

Epistemology is concerned with *what constitutes valid knowledge about the world*. It is how we come to understand the world and in what way this understanding is communicated (Burrell and Morgan, 1979: 1). Is knowledge something that can be externalised and communicated as facts, or does it need to be personally experienced? Burrell and Morgan (1979: 5) present two epistemological positions, namely positivism and anti-positivism. The *positivist* approach advocates a search for regularities within the social world, as well as causal relationships between its components. Hypotheses are used to help prove or falsify claims about regularities. Positivists are interested in growing the knowledge base of accepted regularities. *Anti-positivist* epistemology is against the notion of any laws or regularities to describe the social world. Anti-positivists do not believe knowledge is gained by being an external observer of social activities. They argue that one needs to get personally involved in such activities; "one has to understand from the inside rather than the outside" (Burrell and Morgan, 1979: 5). Knowledge is subjective and cannot be generated objectively.

3.2.1.3 Human nature

Human nature is Burrell and Morgan's way of referring to *the relationship between people and their environment* (1979: 2). Which determines what happens to people: the people or their environment? *Determinism* refers to the extreme belief that people's situation or environment is in control, whereas *voluntarism* assumes free-willed actors, in total control of their destiny. The human nature assumption is the only one where Burrell and Morgan (ibid.) do not feel strongly that a choice needs to be made; according to them, many social science researchers assume an intermediate position.

3.2.1.4 Associated methodology

Burrell and Morgan (1979: 6) conclude their discussion of the subjective-objective dimension by suggesting *methodological approaches* that go along with each orientation. According to them, an objective stance to social science assumes a realist ontology, a positivist epistemology and determinism. Such a stance, which they term *nomothetic*, requires a rigorous scientific method, similar to what is used in the natural sciences. On the other hand, a subjective stance assumes a nominalist ontology, an anti-positivistic epistemology and voluntarism. Such a stance lends itself to an *ideographic* research approach, the researchers trying to place themselves inside the world of the subject by trying to understand its background, history, life world and characteristics.

3.2.2 The regulation or change dimension

When it comes to the *nature of society itself*, Burrell and Morgan (1979: 12-19) identify two fundamentally different sets of assumptions. The first set of assumptions is concerned with the way the status quo is maintained in society, with a striving towards orderliness. According to Burrell and Morgan (ibid.), this kind of thinking can be seen in e.g. Durkheim's work on social cohesion. It refers to the functionalist kind of thinking where systems theory from biology is applied to social systems. How does a system maintain its stability, how is it functionally integrated, and how are users' needs satisfied? Burrell and Morgan refer to this set of assumptions as the *sociology of regulation*. It is more than just a description and assumption of orderliness, it also implies a normative position, namely that the status quo should be maintained and society is best regulated.

The second set of assumptions is concerned with *radical change*. It does more than just point out existing conflict and disintegration, which could be viewed as the normal state of affairs. It refers to the Marxist kind of thinking, that tries to surface structures of domination, the need for change and emancipation. It sees inherent problems and structural contradictions in the status quo and advocates radical change. It is future-oriented and possibly Utopian in its striving towards a better life for the deprived.

According to Burrell and Morgan (1979: 16-19), the assumptions on regulation and radical change move beyond the traditional order-conflict debate, where order and conflict could be viewed as both present in society as part of normal cycles of social systems. Their normative stance implies that the researcher has to take a position, either believing in regulation or promoting radical change.

3.2.3 Burrell and Morgan's paradigms

Based on the joint assumptions relating to the two dimensions discussed above, namely the subjective-objective dimension and the regulation vs. change dimension, Burrell and Morgan (1979) developed *four sociological paradigms*. They called these respectively the functionalist, interpretive, radical humanist and radical structuralist paradigms. In particular, the realist position in ontology, the positivist position in epistemology, the determinist position in human nature and the sociology of regulation characterise the *functionalist* paradigm. Thus, the functionalist paradigm assumes a social world that exists independent of the researcher and about which knowledge can be gained in an objective fashion. The nominalist position in ontology, the anti-positivist position in epistemology, the voluntarist position in human nature and the sociology of regulation contribute to the *interpretive* paradigm. The interpretive paradigm assumes free will and a cognitively constructed world, about which knowledge is gained subjectively, by personal involvement of the researcher. Both the functionalist and interpretive paradigms assume that the existing social order should be maintained. The functionalists deliberately study the mechanisms they believe contribute to order, whereas the interpretivists attempt to understand the current situation from the inside. The *radical humanist* paradigm is similar to the interpretive in terms of ontology, epistemology and human nature, but it promotes radical change or emancipation. The *radical structuralist* paradigm, advocating change from a positivist and deterministic perspective, is used in Marxist approaches (Burrell and Morgan, 1979: 34) and less widely elsewhere. In terms of the general social science research approaches, the functionalist paradigm is associated with the positivist approach, the interpretive paradigm to the interpretivist approach and the radical humanist to the critical approach.

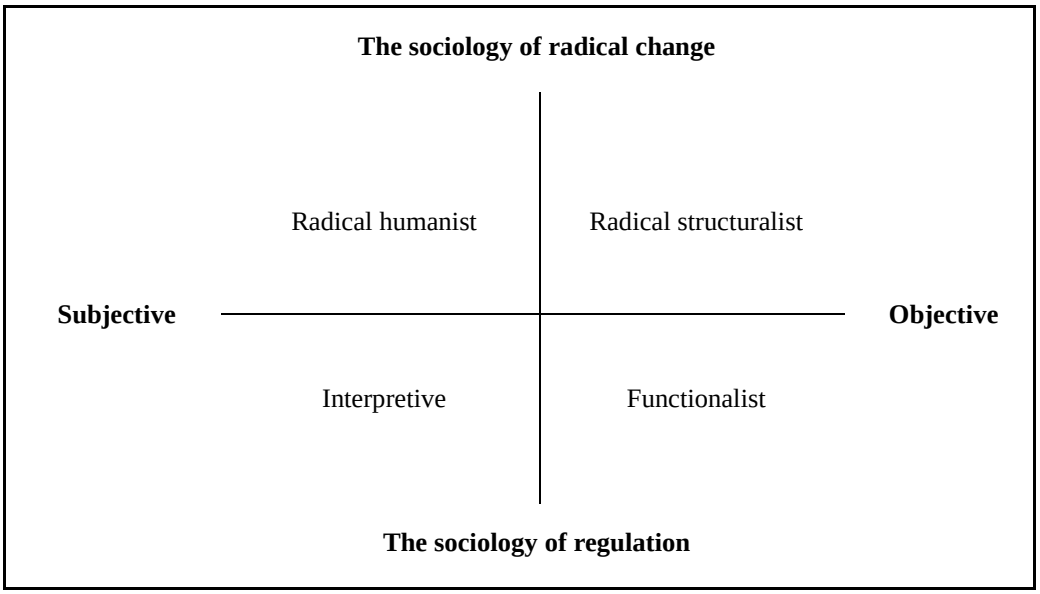

Figure 3.1: The four sociological paradigms
(Burrell and Morgan, 1979: 22)

The four sociological paradigms are summarised in Figure 3.1 above. Before proceeding to motivate the research paradigm of this study, the use of the paradigms within IS and ICT4D will be investigated.

3.2.4 Use of the research paradigms in Information Systems

Oates (2006) as well as Myers (2009) refer to three dominant philosophical paradigms in IS research, namely positivism, interpretivism and critical research. In both authors' cases, the distinction between positivism and interpretivism is only epistemologically based; in other words, Burrell and Morgan's other aspects of ontology and human nature are not discussed. The way critical research is described can be related to Burrell and Morgan's radical humanist paradigm: the epistemological assumptions hold as for interpretivism, but the radical change view is advocated for society as opposed to the regulation or status quo view.

In a seminal article by Hirschheim and Klein (1989), they apply Burrell and Morgan's four paradigms to information systems development. They refer to the distinction in the objective-subjective axis as epistemological only, and to the regulation vs. change axis as ontological. Whereas there is admittedly an ontological aspect to the regulation vs. change views of the social world, Hirschheim and Klein's (ibid.) distinction is confusing as it does not account for the normative aspect. Also, the use of the word 'ontology' on this axis results in the

ontological dimension of Burrell and Morgan's objective-subjective axis being overlooked; Burrell and Morgan's use of 'ontology' being in a more fundamental sense.

3.2.5 Critique of the paradigms

Burrell and Morgan's use of nominalism vs. realism in ontology to distinguish between the interpretive and functionalist paradigms is uncomfortable. Maybe, this is the reason IS research authors such as Oates and Myers only focus on epistemology. Even researchers advocating an interpretivist philosophy may not necessarily want to deny the existence of any degree of independent reality of the social world. Some attempts have been made to deal with this matter, as well as with the problems emanating from the distinction between the interpretive and functionalist/positivist paradigms, in particular those relating to epistemology and human nature. Examples of such attempts, and of research areas that span across Burrell and Morgan's paradigms, are discussed below.

3.2.5.1 Structuration theory

Giddens' (1984) structuration theory is an attempt to bridge the dualism between objectivism and subjectivism in social theory (Mendelsohn and Gelderblom, 2004: 8). Of Burrell and Morgan's three sets of assumptions associated with the objective-subjective dimension, the one Giddens attacks most is the human nature assumption of determinism vs. voluntarism. Giddens does not believe that individual behaviour is merely determined by an externally existing social structure, as do the structuralists whose work would reside under Burrell and Morgan's functionalist paradigm. Neither does he believe that individual agents are totally free and unconstrained by social structures, as does the subjectivist camp whose work would reside under the interpretive paradigm. Giddens replaces the dualism between the camps with the duality of structure, where social action produces social structure, and social structure influences social action.

3.2.5.2 Critical realism

The research philosophy of critical realism appears to specifically deal with the ontology dilemma. Critical realism claims the ontology of realism, namely the existence of a world independent of humans, with structures that have causal powers (Roode, 2003: 1-2; Mingers, 2006: 21). This also holds for social structures. At the same time, it is recognised that the nature of the social world is different from the natural world (Mingers, 2006: 25). Social structures do not exist independent of the social actors involved, and knowledge about these

structures cannot be accessed objectively or in a controlled manner. Despite this so-called epistemic relativity, critical realism advocates that the same, abduction-based critical realist method suggested for the natural sciences is used in social science (Mingers, 2006).

3.2.5.3 Complexity thinking

Notions from complexity thinking have presented challenges to the functionalist/interpretivist divide (Leleur, 2006). When presented with a self-aware, self-reflective and self-referencing system that also observes its environment, what is classified as subject and what as object? Does one assume the ontology of realism or nominalism? Leleur suggests that our perceptions of systems be expanded rather than trying to fit new theories into existing paradigms. He suggests complexity research as an additional paradigm, based on its own set of assumptions. Within this paradigm, he promotes a multimethod approach that uses both hard and soft systems methodologies (Leleur, 2006: 151).

3.2.5.4 Pluralism

Pluralism in methodologies is mentioned by some theorists as a possible way to overcome the limitations in thinking of one paradigm or set of assumptions. Jackson (2003: 282) provides a motivation for combining the philosophical paradigms, using Habermas' work to counter existing arguments of paradigm incommensurability. Jackson's (2003) Total Systems Intervention and Mingers' (2006) call for multimethodology in research and intervention methods both provide guidance as to the systematic combination of approaches; see also Rosenhead and Mingers (2001: 290). Mingers' appropriation of critical realism specifically promotes pluralism (Mingers, 2006: 31), while pluralism is not limited to critical realist research.

3.2.5.5 Systems research

Alter (2004) points to the problematic nature of systems research, not fitting comfortably in either positivist or interpretive paradigm. The complexity that it captures cannot necessarily be reduced to the linear relationships that would make it fit well into positivist research, and the systems nature of a situation does not always lend itself to an interpretive approach. According to Alter (ibid.), research using systems approaches often leads to criticism related to its relevance, rigour and research approach. In this study, which can be classified as systems research, an attempt is made to thoroughly deal with research methodology. At the

same time, it can be seen in the subsequent sections of this chapter that the methodological classification of the work remains problematic in a number of respects.

3.2.6 Research philosophy of this study

The research philosophy for this study is a careful or qualified interpretivism. It is indicated below how a philosophy of interpretivism is broadly rather than closely followed.

The basic assumptions of interpretivism have been discussed in previous sections. From the writings of Myers (2009: 38), Oates (2006: 292), Lee (1999) and Walsham (1995: 378), interpretivism appears to be a better home for a study of the social environment (in IS) than positivism. The research approaches of the natural sciences are not regarded as appropriate for social studies, because they do not have a way to deal with "the human phenomenon of subjective understanding" (Myers 2009: 38). According to Myers, social researchers study subjects and not objects. Social researchers have to deal with a double hermeneutical challenge, of subjects (researchers) interpreting subjects' interpretation of the world. To try and understand a subject's interpretation, one has to move as close as possible to the subject.

Thus, the *epistemology* of subjectivism will be assumed, and the social systems under investigation will be studied from the inside, taking into account the multiple subjective perspectives of the people involved. The interpretive systems view, namely that a system is a subjective mental construct, will be followed (see Chapter 4, on systems thinking). However, much of the useful systems concepts were developed in the positivist domain. These will not be altogether discarded, and when an objective viewpoint needs to be assumed during some stages of analysis, it will be done. Awareness of the point of view of the researcher will be shown as far as possible. Rather than creating a dilemma by not being consistently subjective while doing a systems description, an attempt will be made to strengthen or enrich the subjective knowledge base by adding the assumed view "from the outside" as an additional perspective.

Ontologically, a claim of pure nominalism, as per Burrell and Morgan's interpretivism, will not be made. The possibility of an independent social reality is not ruled out, although subjectivity in the perception of the observer and research participants makes a clear view of such a reality inaccessible. In this study, people's perceptions of social reality and the meaning they construct around it are deemed to be at least as important as the actual underlying social structures.

As regards to *human nature*, an intermediate view will be taken, allowing for both structural influences from the environment and choices exercised by human actors; something akin to Giddens' structuration theory (the latter which is indeed included in the study's theoretical framework, which is discussed in Chapter 7).

In the choice between social *regulation and change*, the order/regulation/status quo position will be assumed. This does not mean that change is not acknowledged or advocated, since change is part of any social setting and any system's life cycle. Rather, it means that the focus will be on *understanding* the *existing social systems* in their current situation, and looking for inherent patterns and organisation. Although an ICT4D initiative involves bringing about change, this study does not advocate disruptive transformation but rather wants to see how existing social practices can be accommodated when technology is introduced in a culturally defined environment.

The theoretical framework for analysis is that of social autopoiesis, incorporating Giddens' structuration theory (Turpin, 2009; Turpin and Alexander, 2010; Chapter 7 of this study). This social systems theory, which use is motivated for later in the study, is placed loosely in the interpretive paradigm, which appears to be an appropriate home for both autopoiesis and structuration theory, at least to the extent that both these theories are non-functionalist and non-teleological (Mingers, 2004: 406; 2006: 19,88). In Section 3.2.5 above, structuration theory is given as an example to critique the interpretive/functionalist divide. While structuration theory presents an attempt to bridge the divide between objectivism and subjectivism in social thinking (as discussed in more detail in Chapter 5), Giddens appears to be interpretive in his approach overall. Autopoiesis theory is not totally interpretive: Bailey describes Maturana and Varela's autopoietic approach as "in many ways just traditional science" while he simultaneously describes it as emphasising "the hermeneutic, the interpretive, the role of the observer in the system" (Bailey, 1994: 286). In Section 6.2.6, the influence of interpretive scholars on Maturana and Varela's thinking is discussed, while some contradictions in the latter's stance are simultaneously indicated.

3.3 The IS and ICT4D research contexts

A concise overview of the IS and ICT4D research landscape is presented below, as context for positioning this research project. Some of the material discussed overlaps with the ICT4D background information in Chapter 2. However, it is reviewed here with a different emphasis, namely the research methodologies that accompany ICT4D thinking.

3.3.1 Research strategies in Information Systems

How does the choice of interpretivism compare to the research paradigms historically and currently applied in IS? As mentioned earlier in this chapter, the dominant research paradigms in IS research are positivism, interpretivism and critical research. IS research, also called MIS research in the United States, started from an almost purely positivist approach, as an extension of computer science (Landry and Banville, 1992; Lee, 1999). However, the significance as well as messiness of the organisational context became more apparent with time, so that other approaches to deal with the social environment became not only accepted but also necessary. Neither Lee (1999) nor Landry and Banville (1992) are convinced of the scientific or practical justifiability of positivism, the latter which has remained dominant in their respective environments during the 1990s. Lee suggests more critical research for the future, such as by using critical social theory, while Landry and Banville advocate methodological pluralism.

Walsham (1995) discusses the slow move towards interpretivism in IS that he has noticed up to 1995. By 2006, he claims and substantiates that "interpretive research in IS is now a well-established part of the field" (Walsham, 2006: 320). Two of the IS journals that are A-rated by the Association of Information Systems (Dwivedi and Kuljis, 2008: 678), namely the *European Journal of Information Systems (EJIS)* and the *Information Systems Journal*, recently published surveys of research approaches used in their journals (Dwivedi and Kuljis, 2008; Avison et al., 2008). Both of these show that the interpretive paradigm has become dominant in their journals, closely followed or matched by positivist studies. Published critical studies are far less frequent, and have only made an appearance relatively recently.

From the above, one can see that interpretivism has become a mainstream research philosophy in IS although it has not been the case initially. Qualitative, interpretive case study research, as is proposed for this study, is the most prominent research approach in *EJIS* publications from 1997 to 2007 (Dwivedi and Kuljis, ibid.).

3.3.2 The ICT4D research context

In the discussion below, the landscape of ICT4D research approaches and discourses is concisely sketched, in order to position this study within the ICT4D research landscape.

3.3.2.1 Addressing the social context of ICT4D research

Where the social context is recognised by IS studies, it is usually that of the business organisation (Lee, 1999: 9). In ICT4D research, the immediate social context is likely to be a community that bears little resemblance to a business. Along with 'community' often come factors such as a different culture, language, power structures and economic activity. Thus, the social context in an ICT4D study cannot be studied in the same manner as the social context of a traditional IS project; it requires additional care. In Avgerou's (2008; 2009) ICT4D research discourses, it is indicated how the added challenges of studying a community in a developing country context are addressed differently by researchers with differing sets of assumptions about innovation and development. After having introduced them in Chapter 2, Avgerou's discourses are revisited below to see what their associated research methodology implications are.

3.3.2.2 Research approaches associated with the ICT4D discourses

In Chapter 2, three prevailing discourses in ICT4D research are discussed, namely "transfer and diffusion", "social embeddedness" and "transformation" Avgerou (2008); the latter is subsequently divided into "progressive transformation" and "disruptive transformation" (Avgerou, 2009).

What are the research approaches associated with each? From Avgerou's (2009) discussion of the transfer and diffusion discourse, this discourse appears to go along with the studying of technology acceptance factors in developing countries. From Avgerou's discussion, the researcher infers that the transfer and diffusion research could be associated with a positivist research philosophy.

The social embeddedness discourse with its focus on understanding local social dynamics and local processes of IS innovation (Avgerou, 2009) is inferred to go along with an interpretivist research philosophy. This would be consistent with researchers in the social embeddedness stream's extensive use of social theory, such as structuration theory, Actor Network Theory, contextualist theory and activity theory (Avgerou, ibid.).

The discourses concerned with "transformation" (Avgerou, 2008), in particular "disruptive transformation" (Avgerou, 2009) has a critical stance, often drawing from critical social theory. Since it questions agendas for development and attempts to uncover power struggles

and exploitation within the local environment, it can be associated with a critical research philosophy.

3.3.2.3 An ICT4D research survey

In Walsham and Sahay's (2006) survey of the ICT4D research landscape between 2000 and 2004, they investigated ICT4D articles in 13 major IS journals as well as ICT4D conference proceedings. In terms of methodology, they found the majority of papers to be interpretive, according to them a natural fit with the nature of questions and issues addressed in these papers. Walsham and Sahay (ibid.) believe that when comparing this set of research with work done prior to 2000, the research methodologies of the recent papers were more solid and of a better quality. They mention in particular that there are more in-depth case studies in the recent work.

3.3.2.4 The ICT4D discourse associated with this study

Within Avgerou's discourses, this study is closest aligned to the "social embeddedness" view of IS innovation. It specifically aims to understand and describe the social context where an ICT4D intervention takes place. In terms of the transformation view, it does not take a stance that unquestioningly assumes ICT's positive role in economic development, nor does it take a stance that is explicitly critical. It is neutral in the sense that it wants to assess the influence of an ICT4D project on its system served. The ICT4D project hopes to make a contribution by assisting local initiatives that have a track record of successfully providing education, health care and social care within the community, to expand and improve their reach by means of ICT. There is an awareness of inequalities and tensions within the community, and the researchers on the project are not uncritical of the assumptions made by foreign donor agencies involved. Overall, the view is that careful introduction of ICT into existing institutions that contribute towards socio-economic development, will assist those institutions to better achieve their developmental objectives. Thus, the transformation view of the study is perhaps closer to "progressive" than "disruptive" transformation, without taking a strong "progressive transformation" view. The ICT4D research paradigm most closely associated with the mentioned assumptions is described by Avgerou as "ICT and development as socio-economic improvements though locally situated action" (Avgerou, 2009: 21). Since "social embeddedness" is its strongest feature, it will be referred to in this manner, rather than using the full name of the research paradigm.

As indicated in a previous paragraph, the "social embeddedness" view is associated with interpretive research, which according to Walsham and Sahay (2006) is also the dominant research methodology in ICT4D. Thus, the choice of an interpretive research methodology for this study is consistent with the research stream it aligns with as well as with ICT4D research in general. This study's aim of explicitly dealing with the social context in an ICT4D study is well represented by the "social embeddedness" view.

3.4 Research strategy

In this section, the research strategy of this study, namely case study research, is motivated and discussed. The research strategy is revisited in a reflective manner in Chapter 9, as a prelude to the data analysis.

According to Flyvberg (2006), all knowledge about the social world is context dependent. People learn more effectively from cases than from rules, because of the presence of context. As such, case studies are not only useful but necessary as a means to convey knowledge. Flyvberg also refers to Kuhn, who stated that in order to be effective, a discipline requires a large number of thoroughly executed case studies as exemplars (Flyvberg, 2006: 242).

3.4.1 Case setting

The case study presented in this research is a longitudinal single case study. Researchers from the University of Pretoria have carried out IT training in the deeply rural community of Tugela Ferry in KwaZulu Natal. Tugela Ferry is a geographically remote settlement in a designated Zulu tribal area, which means it is part of South Africa but the land is controlled and managed by the Zulu kingdom, by means of a traditional leadership structure. Centrally located in Tugela Ferry is a Christian mission. IT literacy training took place at the mission school on their invitation. The two interdependent communities most closely involved and affected by the IT project was the traditional Zulu community with its centuries old set of cultural practices, including an ancestral belief system, and the Christian mission community, with its Western and Zulu staff as well as predominantly Zulu congregation members. These two communities represent the 'systems served' by the ICT4D project, using the language of Checkland and Holwell (1998), and have accordingly been selected to describe and analyse as the social systems of concern.

The above case has been chosen because of its strong set of social system characteristics, which proved promising in terms of a systems modelling exercise. In terms of Oates' possible reasons for selecting a case (Oates, 2006: 144), this case was chosen while it provided a unique opportunity, and to be a test-bed for a social systems theory. The researcher decided to immerse herself in the case as a single case study, since the particular social environment proved a challenge to understand culturally, and contained enough internal variety and complexity to justify expending all her efforts on it.

3.4.2 Case study format

The case study takes the form of a descriptive as well as an explanatory study. In a descriptive study, a "rich, detailed analysis of a particular phenomenon and its context" (Oates, 2006: 143) is provided. An explanatory study attempts to add to this description an explanation of why certain outcomes occurred. According to Gregor, a theory for explaining could also be called a theory for understanding: it attempts to show "how the world may be viewed in a certain way, with the aim of bringing about an altered understanding of how things are or why they are as they are" (Gregor, 2006: 624). In the Tugela Ferry case, a rich description of the two social systems that were identified, is used with the eventual aim of assessing the ICT4D project's developmental impact on these social systems.

3.4.3 Time frame

The time frame of the case is the duration of the IT project, from its inception in 2009 until its effects could be observed in the community. The time period for observing effects is around two calendar years from when the first formal IT training took place, up to August 2011. Within this period, a number of site visits by combinations of members from the implementation and research project team have taken place, including five visits by this researcher. An iterative sense-making process oscillating between on-site fact-finding and back-office study and reflection has taken place during this period, with data collection and interpretation influencing each other.

3.4.4 Generalising from the case

Will it be possible to generalise from this case study? An interpretive case study focuses on understanding "from the inside" and attempts to generate in-depth knowledge about a particular situation. As such, its relevance may be in basic knowledge accumulation, which is not necessarily less valuable without generalisation (Flyvberg, 2006: 227).

According to Oates (2006: 145) it is possible to generalise from a single case, to the extent that it has characteristics typical of other cases. Flyvberg (2006) discusses the trade-off between the generalisability that is possible on a typical case and the value gained from studying an unusual case. He argues that one might learn more from studying a less typical case, which has been carefully selected because of the relationship of the unusual attributes to the theory or proposition investigated. The Tugela Ferry case held promise for applying the selected social systems theory, as discussed in more detail in Chapter 5. Since this case represents the first time that the particular theory is applied, it is important to aim for success: only after a first-time success will the wider applicability of the theory become relevant. It can be viewed as a critical case in the sense that if the theory cannot add value to this case, it is unlikely to add value in other cases (Flyvberg, 2006: 230).

3.4.5 Principles for conducting interpretive case study research

Klein and Myers' (1999) principles for interpretive field studies are used to guide empirical work on the case study. These principles take a hermeneutic approach to interpretive research, and attempt to make practical suggestions based on interpretivism's philosophical foundations. The seven principles, as summarised below, have been used to guide the study's research process, and data collection in particular:

The fundamental principle is that of the *hermeneutic circle*. The understanding of the whole is influenced by an understanding of the parts and vice versa. This process continues over time, so that every time new meaning is gained in one area, the interpretation of the entire rest of the system under investigation needs to be reassessed. This researcher's understanding is that the research planning/theoretical lens and collected information also inform each other continually over time, as part of the hermeneutic circle.

The principle of *contextualisation* states that the background and history of a case setting needs to be taken into account when interpreting the current situation, also for the benefit of the reader of the researcher's work. However, an interpretive approach recognises that context cannot be used to predict, is dynamic and can be influenced by the researcher.

According to the principle of *interaction* between researcher and subjects, the information that is collected is not "out there" but constructed in the interaction between the researcher and subjects. Not only does the researcher subjectively interpret, but the way participants

present information is influenced by how they view the researcher, how they interpret and are influenced by the research process.

The principle of *abstraction and generalisation* requires the ability to conceptualise the information collected in the ways described above. Theory is often used as part of the abstraction, providing a way to package concepts, provide insights and draw conclusions.

The principle of *dialogical reasoning* asks the researcher to critically revisit the assumptions that have been made at the start of the research process, which led the researcher to use a particular theory or design the research in a certain way. What were the propositions and what story did the data really tell? The aim is not to eliminate prejudices but to surface them and to indicate whether or where they have changed. In line with this reasoning, Flyvberg (2006) advises that the researcher is on the constant lookout for information that could be used towards verification (confirmation of assumptions or propositions) as well as falsification (finding evidence contrary to assumptions or propositions).

The *multiple interpretations* principle requires that the researcher actively seeks for multiple viewpoints in a situation, records them and also tries to make sense of possible reasons for the differing views. Having to find a conceptual means to accommodate differing views may lead to a new interpretation of the situation.

The principle of *suspicion* requires the researcher to be on the lookout for inconsistencies in the data, and to question the surface meaning of what people say. It might happen that people provide false or distorted information because of their own agendas. Since interpretive research needs not be critical, Klein and Myers (ibid.) regard this principle as optional.

In the Conclusion of the study, these principles are revisited as part of an assessment of the way the empirical research has been conducted (Section 10.3.2).

3.5 Using a theory

As mentioned in section 3.2.6, a systems theory of social autopoiesis is used on the case study, of which the principles are discussed in Chapter 6 and the application framework in Chapter 7. Walsham (2006: 324) suggests that in interpretive IS research, theory could be used in three ways, namely “as an initial guide to design and data collection, as part of an iterative process of data collection and analysis, or as a final product of the research.” In this

case, theory is used iteratively for data collection and analysis while the theory is refined in the process. As such, the theory not only deductively informs the data collection and analysis but is also a product of the research process.

Walsham (2006: 324) admits that the choice of a particular theory is always subjective. In his analysis of a few literature cases where a theory was used, the only consistent rationale he could find for the choice of theory was that it "spoke" to the authors. He suggests that researchers choose a theory firstly because they feel personally comfortable with it and it appears insightful to them. If they are themselves convinced of its use, it will be easier to convince the research audience. However, there should be some basis to motivate for its use, after having read widely on different theories and listened to others' advice on what works for them. If the potential value of using a theory needs to be confirmed, a preliminary analysis can be done and presented as a working paper or at a conference, with the author requesting feedback.

Truex et al. (2006) propose that the following aspects are considered when adapting a theory from another domain into IS research: the fit between the theory and phenomenon of interest, the theory's historical context, the fit between the theory and research method, and lastly the contribution of the theorising process to cumulative theory, meaning that the new theory should be compared to existing theories when arguing for its value addition.

Walsham's (ibid.) as well as Truex et al.'s (ibid.) criteria are revisited in Chapter 5, when criteria for selecting a social systems theory are presented.

3.6 Information collection

The selected research strategy is a case study. The centrality of cultural aspects in the study calls for the supplementation of 'typical' case study information collection methods, namely interviews and documents (Myers, 2009: 79) with ethnographic methods such as field notes. As such, the researcher does not subscribe to the strong distinction made, almost a mutual exclusivity, between the case study and ethnographic research methods, as found in Myers (2009).

Empirical information has been collected by means of observation, interviews (semi-structured and unstructured) and relevant documentation. Information is predominantly qualitative. Observation has been performed with two aims. Firstly, general contextual

knowledge was seen to be important because of the central role of cultural practices in the study, in particular the lifestyle of the deeply rural Zulu people and the mission culture. To some extent, the researcher will always remain an outsider when visiting the community. However, some participant observation was done where opportunities arose (Myers, 2009: 138). This did not take the form of living like the people, but rather participating in selected social and work activities as makes sense. The ethnographic method of making field notes (Oates, 2006: 176) has been used extensively while visiting the site. Secondly, during observations the researcher was on the constant lookout for specific information to populate the theoretical framework. Interviews were also conducted with the theoretical framework in mind. It was found that the highly abstract theoretical concepts of the framework required careful 'translation' in order to be suited as interview questions and topics, given the local context that was very different from the researcher's life world. The research also made use of a third information source mentioned above, namely documents, in the form of census data and community-specific reports.

3.6.1 Ethical aspects

The ethical clearance procedure of the university required gaining informed consent from respondents interviewed. However, in the Tugela Ferry case, the extreme vulnerability of the community asked for additional care with ethical matters. The project team on the ICT4D project set some practical ethical guidelines to themselves, including constant awareness by the researchers of ethical dilemmas. Some such possible dilemmas are discussed by Walsham (2006: 327). He mentions commonly accepted ethical criteria of harm to participants, informed consent, privacy and deception. In addition, he discusses criteria originating from dilemmas that he has personally experienced, around non-disclosure of identity, keeping the interests of the organisation (community) at heart and critical reporting in the literature. In Chapter 9 of this study, some ethical matters that were practically encountered in Tugela Ferry are discussed, along with the results of the data collection exercise.

3.7 Information analysis

Information has been analysed and reported on using the concepts of the theoretical framework, the results of which are presented in Chapters 8 and 9. As a guideline for data analysis, Walsham (2006: 325) warns that whatever the analysis method chosen, the researcher's common sense must take precedence. In other words, one should not get so locked in to an analysis process or theory that something else emerging from the data might

get lost. In this study, the iterative process of revisiting the theoretical framework while doing data collection gave the researcher the opportunity to deal with some mismatches between what the data indicated and what the theory assumed.

3.8 Research audience

The audience at which this research is aimed, is the ICT4D research community as well as the systems thinking research community. Even though the traditional IS research community is not a primary audience, the treatment of the social context of an information system from a social systems angle is believed to also have value to the IS research community.

3.9 Contribution to knowledge

How will the study's contribution to knowledge be assessed? Myers states that a case study's contribution to knowledge is found in the generalising from the findings, as shown conceptually or by means of a theory (Myers, 2009: 84). The ability to generalise has been discussed in section 3.4.4. Further, according to Gregor, the contribution to knowledge that is expected when using a theory for explaining or understanding is "whether new or interesting insights are provided". It is also judged on the "plausibility, credibility, consistency, and transferability of the arguments made" (Gregor, 2006: 625). Thus, one needs to show credibility in the research process, information collection and argumentation throughout the process. The provision of new or interesting insights is understood to be the ability of the research to let the reader see the situation in a new or different light.

In this study, systems thinking is used to describe the multiple social systems involved in an ICT4D project as well as their mutual interaction. The systems described are the systems served as well as the serving system. From this description, the impact on socio-economic development of the ICT4D project on the systems served is assessed. In Chapter 2, the assessment of ICT4D's contribution to development has been noted as a prevailing problem, and that systems thinking can assist with this problem but is seldom used in ICT4D. The development of a social systems framework to describe and assess the impact of an ICT4D project on its systems served is accordingly regarded as a contribution in the field of ICT4D. In particular, the use of social autopoiesis to assess the sustainability of a social system, as well as the impact of ICT4D on the sustainability of its systems served, is a new or different way to assess sustainability in ICT4D. The theoretical contribution of the study is evaluated in Chapter 10, using the criteria suggested by Whetten (1989).

3.10 Limitations of the study

The study limits itself to the application of systems thinking in ICT4D. However, a large portion of the work involves traversing the general systems thinking and social theory literature, as preparation for developing a social systems framework. As such, a large portion of the work presented in this study is not traditional IS research and also goes beyond the ICT4D domain. In line with the thesis' use of systems thinking to describe the social context in ICT4D, Checkland and Holwell's (1998) systems-based definition of an information system, discussed in section 2.2.2, is used throughout.

A theoretical feature of the study is its use of a combination of social and systems theories in an unconventional way, as compared to mainstream IS and even ICT4D literature. Even the manner in which Giddens' (1984) structuration theory is applied deviates somewhat from its usual application in IS. This study does not limit itself to incrementally building on similar previous work in the field, although relevant work is acknowledged where possible. The results of this study could not have been achieved through incremental work only. While the nature of the study required such an unconventional and multidisciplinary approach, it may limit the acceptability of the work by the mainstream IS research community.

Empirically, the research is limited to a single case study. The case setting is the Msinga municipal district in KwaZulu Natal, South Africa, and in particular the deeply rural village of Tugela Ferry that is situated in Msinga.

While doing data collection in the case setting, the researcher remained an outsider to the community, not being a native Zulu nor being able to speak Zulu. While making extensive use of cultural interpreters, and gaining the perspectives of multiple interviewees as far as possible, the research remains the interpretations of an outsider.

The literature reviewed, in particular the literature relating to ICT4D, systems theory, social theory and autopoiesis, does not include work published after August 2011.

3.11 Conclusion

In this chapter, the research philosophy of this study has been presented with reference to the research assumptions discussed in e.g. Burrell and Morgan (1979). This philosophy has been compared to the prevailing research methodologies and research thinking in IS as well as

ICT4D. Following this, the planning and execution of a case study research project has been discussed. Research planning and execution has been frequently compared with criteria suggested in the literature, such as Walsham (2006) and Klein and Myers (1999). The researcher indicates how the project could make a contribution to knowledge, and what the study's limitations are. Having gone through this process, the research methodology and planning for the study has been thoroughly set out and motivated.

Having presented the research methodology, the study now proceeds to its theoretical component, the aim of which is to develop a social systems framework. The first theoretical chapter deals with systems thinking and systems approaches.

Chapter 4 Systems thinking and systems approaches

4.1 Introduction

This is the first in a series of four chapters concerned with identifying a suitable systems approach for application to the ICT4D case study. Chapter 4 in addition provides the systems background for a thesis based on systems thinking. It contributes to the first part of the research question below:

- How does the literature approach social systems, from systems thinking and from social theory perspectives?

The aim of this chapter is to survey the field of systems thinking, searching for ways of thinking as well as particular systems methods that could be used to describe and investigate social systems within an ICT4D context. The ICT4D context in this study entails the meeting of different worlds: different languages, different cultures, different environmental and geographical settings, different knowledge bases, and different conceptions of authority, to name a few. Although there is no explicit conflict in the case study context, there is clear poverty and inequality and implicit ethical and normative concerns. Further, socio-economic development is a complex concern that cannot be reduced to aspects such as economic growth, or by a simplistic view of technology as an instrument towards development.

It has been shown in Chapter 2 that there is a clear lack of systems thinking in ICT4D, with very little guidance from existing literature on how to apply systems thinking in ICT4D. If one wants to use a systems approach to investigate the social context of an ICT4D project, and use the same systems description to assess the ICT4D project's impact on development, how does one choose between the available systems theories and approaches? There are some systems approaches that focus on dealing with multiple stakeholder perspectives, some approaches dealing with emancipatory concerns, and yet other approaches to deal with complexity – while all of these concerns are shown above to be found in the ICT4D context. Before deciding on a systems approach, or even before deciding how to decide, an overview of systems thinking applied to social systems is required. Also, an overview of systems thinking itself is required, to ensure that the ICT4D systems application does justice to the nature of systems thinking.

This chapter attempts to convey the distinctive characteristics of systems thinking, and give an overview of systems approaches. The systems landscape is categorised into hard, soft and critical systems approaches, loosely following the thinking of e.g. Jackson (2003) and Daellenbach and McNickle (2005). There are also sections dedicated to complexity thinking, postmodern systems thinking and multimethodologies. This chapter does not provide a comprehensive overview of systems methods, but rather traverses the variety of systems thinking available. Hard systems approaches are included, even if they are not candidates for use in an ICT4D context. They convey something of the classic nature of systems thinking and are the theoretical parents of subsequently developed approaches that may be more suited to deal with a social context.

4.2 Systems thinking: background and overview

This section provides a general overview of systems thinking since its inception up to recent applications in social systems. Apart from providing a concise history of the systems field, it discusses some definitions, distinguishing features of systems thinking as well as the benefits of using a systems approach.

4.2.1 Departure points

Systems thinking differentiates itself by adopting a holistic approach; that is, by studying the whole entity as a way to understanding its component parts (Checkland, 1999: 13). This is in reaction to "reductionist" thinking which attempts to understand an entity by studying its parts. The holistic approach assumes that a system has emergent properties that cannot be seen when studying the parts. Whether systems thinking is anti-reductionist or just "more than reductionist" is a point of disagreement among systems thinkers. The view that systems thinking is the holistic alternative to reductionist approaches is supported by Jackson (2000, 2003). On the other hand, Daellenbach and McNickle (2005), Ritchey (1996) and Barton and Haslett (2007) believe that the holistic and reductionist views of a system are complementary. According to Ritchey (1996: 8) the distinction between the two systems levels, that of the behaviour of the system as a whole and the relationship between its parts, is fundamental to the systems concept. The latter position will be taken from here on, namely that both the whole-view and the parts-view are needed for better understanding of the functioning of a system, whether manufactured or natural, and that systems thinking contains both holism and reductionism.

A second departure point for systems thinking is its transdisciplinary nature, as promoted by von Bertalanffy (1968). If, for example, the operation of a biological entity is described in an abstract language, and the principles discovered can be applied to other kinds of environments, such as organisations, this is regarded as systems thinking.

4.2.2 History of systems thinking

The philosophical basis for systems thinking was promoted by Greek philosophers, such as Plato, who observed that a ship is steered in the same way as the state. Other contributors included Kant and Hegel (Jackson, 2003: 4).

The first two formal systems movements developed more or less simultaneously during the 1940s (Capra, 1997: 96; Checkland, 1999: 14). The one was formed around von Bertalanffy's General System Theory (GST) and the other around cybernetics.

Between 1940 and 1968 the biologist von Bertallanfy developed his General System Theory (GST). He attempted to make abstract the properties and behaviour of biological systems so that they could be applied to other contexts. Among others, he introduced the concept of an open system, noting the importance of understanding a system's interaction with its environment (Jackson, 2003: 4-7). The GST school wanted to encourage the development of adequate theoretical models in areas that lacked them, eliminate duplication of theoretical efforts in different fields, encourage the transfer of approaches between fields of application, and improve communication between specialists (Hitchins, 2003).

Von Bertalanffy's counterpart in the cybernetics movement was Norbert Wiener, a mathematician and control engineer. Wiener defined the term cybernetics as the "science of communication and control in animal and machine" (Jackson, 2003: 7). His interest was in the control process, which requires a system with a goal orientation and negative (corrective) feedback. Communication is also important, since information needs to be transferred between the system and its controller. In the cybernetics movement, Wiener was joined by Ashby (1956) who introduced the concept of variety. Ashby's law states that the controller must have the same degree of variety as the controlled system in order to control it (Jackson, 2003: 7-9).

The GST movement is primarily associated with biological thinking, or the study of living systems. Cybernetics is associated with machine thinking (Olsson and Sjöstedt, 2004: 37) and

has been used and informed by engineering, for example when control systems are designed and built. However, Buckley (1967) argues for the usefulness of cybernetics concepts to study social systems, and cybernetics has been applied by Beer to improve organisational design (Jackson, 2003).

During World War II, the original methods of Operations Research (OR) were developed, using mathematical techniques for the improved performance of military operations. OR incorporated systems principles into its mathematical toolkit, and grew into a strong domain of its own. The techniques developed in OR to improve military performance were subsequently applied to improve organisational performance, contributing to the field of Management Science (McLoughlin, 1999). Related to OR is Systems Engineering, established in the late 1950s and aiming to provide engineers with a systems toolset to assist during the entire lifecycle of a designed system (Olsson and Sjöstedt, 2004: 45-48).

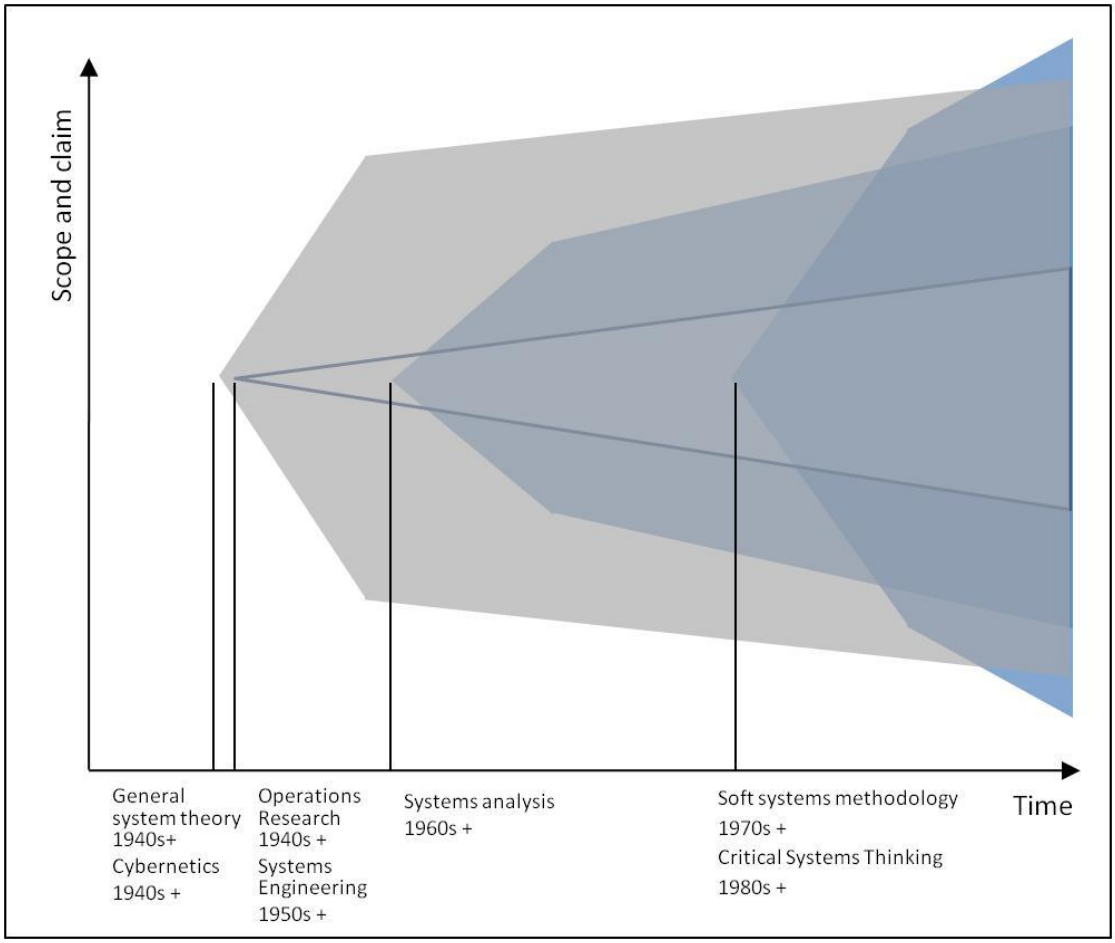

Figure 4.1: The relation between various "schools" of systems thinking (based on Olsson and Sjöstedt, 2004)

During the 1970s, there was an international trend to question positivism and the related thinking of social regulation. This trend influenced the systems thinkers, who realised that the objective, rational, analytic systems approaches, such as found in OR and Systems Engineering, had limited applicability to organisations and other social systems. In response, Checkland's Soft Systems Methodology (SSM) was developed in order to deal with systems that included people, with their varying worldviews and objectives (Rosenhead and Mingers, 2001). The Critical Systems movement went further by addressing not only plurality (many viewpoints) but also unequal (and unfair) power relations in social settings (Jackson, 2001).

Figure 4.1 is based on Olsson and Sjöstedt's (2004: 34) interpretation of how the various schools of systems thinking are related. It gives an indication of the dominance of certain kinds of thinking in approximate time periods. For example, the middle of the twentieth century is associated with the thinking of positivism, and this is the time during which Systems Engineering and Operations Research started growing in significance. SSM and CST both developed later in the twentieth century in reaction to the shortcomings found in positivist systems approaches. Note that some schools of systems thinking are grouped together in Figure 4.1 because of similar scope and claims, even if they originated in slightly different time periods.

4.2.3 Defining a system

Systems thinking, as manifested in design, engineering, development, or analysis, is usually applied when dealing with "real" systems. However, the view taken here is that systems thinking refers to a mental exercise (Olsson and Sjöstedt, 2004: 20-21; Checkland, 1999). A system is a mental construct or a model of reality. The particular systems approach that is applied, is chosen to fit the purpose of the study or project.

Jackson's (2003: 3) concise definition of a system is "a complex whole the functioning of which depends on its parts and the interactions of those parts." Jackson's emphasis on systems thinking as holism is clear from this definition.

According to Hitchins (2003: 26), a system is "an open set of complementary, interacting parts with properties, capabilities and behaviours emerging both from the parts and from their interactions".

Daellenbach and McNickle's (2005: 27) definition also highlights the relationship between the properties of a system and those of its components: each component influences and is influenced by the system as a whole, and each component contributes uniquely to the emergent behaviour of the system. Furthermore, components may be subsystems.

4.2.3.1 Systems vocabulary

Some general systems terms are discussed below. Other vocabulary, which is specific to a particular systems approach, will be introduced together with that approach.

Boundary: indicates the separation between the system and its environment. According to Daellenbach and McNickle (2005: 29), the selection of the boundary is the most critical part of the systems process. It involves not only logical but also value judgements, so that a large portion of the energy of the critical systems movement is spent on questioning boundary choices.

Function (input → transformation → output): a system is usually described in terms of its functionality and/or its structure. In systems design or analysis, the functional description is completed before the structural design. The functional view states the transformation function of the system, or how it changes inputs into outputs. A system transforms energy, matter and/or information. The main transformation function can be decomposed into secondary functions, all contributing to the execution of the main function.

Structure (hierarchy): a structural description will focus on the components, how they are arranged in a hierarchy of subsystems, components and elements and how all of these are connected. In general, a system is always part of a supersystem or relevant environment, beyond which the further environment is ignored. Within, it always contains a lower-level arrangement (Daellenbach and McNickle, 2005: 27-29). According to Hitchins (2003: 24), hierarchy and emergence go together; that is, system properties at a higher level in the hierarchy emerge from the units at the lower levels.

Feedback: Feedback loops can be planned or unintended; they can form within a system or in relation to the system's environment. Feedback loops are either positive (reinforcing) or negative (corrective). Positive feedback can lead to instability or self-destruction if a system's variable(s) take on increasingly larger and larger values, for example, temperature, speed, or size. Negative feedback is a form of regulation. It assists in maintaining or bringing a system

closer to a desired state (Daellenbach and McNickle, 2005: 43). Most natural and manufactured systems rely on negative feedback as a means of control. A self-regulated system contains an internal control mechanism. An example of self-regulation in a natural system is homeostasis, such as the maintenance of a desired temperature in a mammal's body despite external changes in temperature. Feedback control in a manufactured system is normally by means of an external or control system, such as anti-skid technology that is added to a car's steering function to prevent it from sliding out of control.

Emergence: the behaviour of the system that results from the interaction between its components, that is not reducible to any of its individual components or subsystems (Daellenbach and McNickle, 2005: 39). Emergent behaviour can be either planned, as is the case with designed systems, or unintended. Unintended emergence in a manufactured system is often undesirable (in which case the systems design must be adapted to manage it) but it might also be beneficial. In both cases, the investigation of unintended consequences can lead to a better understanding of the functioning of the system.

Open and closed systems: these concepts, introduced by von Bertalanffy, distinguish between systems interacting with their environment by means of inputs and outputs, and systems that are isolated from their environment (Daellenbach and McNickle, 2005: 41). A closed system is a theoretical construct that does not exist in reality. For the sake of simplicity or control, it might be assumed that a system is closed, or an attempt might be made to create a situation where a system is relatively closed.

4.2.4 Analysis and synthesis as part of a systems approach

According to Ritchey (1996: 7), the systems concept always distinguishes between two different levels, namely "the system as a functioning unit and the system as a set of interacting parts". The processes associated with these two levels, are analysis and synthesis. Analysis means "to loosen up" and synthesis "to put together". Ritchey regards analysis and synthesis as complementary and part of an ongoing cycle. The one is not more important than the other, but sometimes the one is more suitable. This is in direct contrast with what Ritchey calls misleading thinking, namely that analysis is bad and reductionist, and synthesis good and holistic.

Ritchey (ibid.), based on a groundbreaking study by the mathematician Riemann on the working of the ear, shows that Riemann's study was successful because he, other than

previous researchers, started by first looking at what the ear *accomplishes*, i.e. its emergent properties. Riemann follows the analysis process as described below and is able to account for aspects of the working of the ear that could not previously be explained.

4.2.4.1 Analysis

The analysis process starts by investigating what a system does or accomplishes as a unit, and from there attempts to understand the inner working of the system. It seeks causes of given effects. Ritchey (ibid.) summarises the analysis process as follows:

- What problem is being solved by the system? I.e. what is the primary task of the system?
- What would the secondary tasks need to be that will help to achieve the primary task?
- Is this set of tasks/functions *sufficient* to perform the primary task? Are all of them *necessary*?
- In what manner can these tasks be implemented? In other words, what possible components can be used?
- Verify the conceptual design obtained from the above by a synthesis process: will this design lead to the outputs of the system as can be determined from experience?

What Ritchey refers to, is an analysis of function. He contrasts this with an analysis of structure, which he labels reductionist. Ackoff (1999: 17) suggests similar steps for a systems approach: first to identify the larger or containing whole of which the entity to be investigated is part, secondly to investigate the behaviour of the containing whole, and thirdly to investigate the behaviour of the part in terms of its role within the containing whole.

4.2.4.2 Synthesis

The synthesis process starts by investigating a system's components, internal structure and processes, and attempts to understand how these work together to create the system's outputs. It infers effects from given causes. The system is built up from its lowest level. Ackoff (1999) uses the word synthesis in a different way. It appears to the researcher that this is only a matter of semantics and that Ackoff's and Ritchey's arguments are actually the same.

The above discussion of the analysis and synthesis processes is based on the study of an existing system. It could also be applied to a designed system, where an analysis needs to be

performed in order to design a system that will meet certain requirements, followed by a synthesis or construction of the system.

4.2.5 Developing systems hierarchies

The following are attempts to arrange or classify systems in a hierarchy, with increasing levels of complexity:

- Early in the 1800s, Comte suggested a hierarchy of the sciences that arranges mathematics, astronomy, physics, chemistry and the biological sciences with social science at the top (Checkland, 1999: 61).
- Boulding's classification, developed in 1956, identifies nine system levels, increasing in sophistication from static structures, through living organisms to societal systems (Hitchins, 2003).
- Miller's Living Systems Theory, published in 1978, recognises eight levels of complexity in living systems, namely cells, organs, organisms, groups, organisations, communities, societies or nations and finally supranational systems (Bailey, 1994).

In all the systems categorisations and hierarchies that have been studied, *social or societal systems are regarded to be the most complex*. August Comte, who founded the term "sociology", based his argument for a new scientific discipline to study social science on such a suggested hierarchy. As can be seen above, more recent contributions such as Boulding's and Miller's followed the same thinking, showing that social systems inherit properties from systems lower down the hierarchy, but they cannot be explained by reducing them to any of the lower levels.

4.2.6 The benefits of a systems approach

Jackson (2003: 13) presents four arguments to promote the systems thinking by managers. The first is systems thinking's emphasis on holism, which provides a major improvement on reductionist thinking, when having to deal with complex situations where understanding the relationships between the parts of a system is important. Second, systems thinking focuses on process in addition to structure, leading to a more open-ended design that allows for unforeseen situations and possibilities. The third argument is systems thinking's transdisciplinarity, which allows for drawing on strengths of concepts from other disciplines. Jackson (ibid.) argues that, even if analogies are not fully transferable, they can assist with

gaining new insights into existing problems. Fourthly, Jackson argues that the systems discipline has proved itself more suited to dealing with management problems than any other individual discipline.

According to Daellenbach and McNickle (2005: 19), systems thinking provides a way to study the effectiveness of a system as a whole. It also provides a way to recognise and conceptually deal with unintended consequences. These motivations are similar to Jackson's first two arguments. Daellenbach and McNickle teach management science and decision-making by means of a systems thinking framework, which they believe provides an advantage to their students (Daellenbach and McNickle, 2005: xiii).

4.2.7 Useful systems concepts for ICT4D

Based on the discussions above, the following systems concepts are perceived as useful for studying a social system into which an ICT4D project is introduced:

- The view of a system as a subjective mental construct provides the ability to distinguish between a systems description and a real-world situation. It gives the analyst the freedom to develop constructs that make sense in the particular setting, and in the process to use theory of her choice. It also acknowledges the researcher's subjectivity;
- Systems thinking's transdisciplinarity, which allows for introducing theory or concepts from other disciplines in order to gain insight into a situation;
- Systems thinking's balancing of the whole-view and the parts-view;
- In line with the previous point, the process suggested by Ackoff, namely to first identify the larger or containing whole of which the entity to be investigated is part, then to investigate the behaviour of the containing whole, and lastly to investigate the behaviour of the part in terms of its role within the containing whole;
- In ICT4D, to apply Ackoff's thinking by identifying ICT4D's containing social system as the 'containing whole', then to investigate the behaviour of this containing whole, and lastly to investigate the behaviour of the part (the ICT4D project) in terms of its role within the containing whole;
- Systems thinking's focus on the effectiveness of a system as a whole, together with Ackoff's process, allows an ICT4D intervention's influence on the well-being (in this case, development and sustainability) of the larger social system it forms part of, to be assessed.

4.3 The various systems approaches

The main categories of systems approaches correspond with the three main research paradigms, namely positivist, intepretivist and critical. Table 4.1 below is an attempt to map and compare the categorisations that were done by a number of theorists, such as Habermas, Burrell and Morgan as well as Jackson. They have similar underlying thinking but somewhat different terminology.

Systems paradigm	**Hard**	**Soft**	**Critical**
Systems approaches	Systems Engineering Systems dynamics Cybernetics Systems analysis Operations Research (OR) Non-linear dynamics	Soft Systems Methodology Other Soft OR approaches: SODA, Strategic Choice Multiple Perspectives Approach	Critical Systems Heuristics (CSH) Total Systems Intervention
Sociological paradigm (Burrell and Morgan, 1979)	Functionalist	Interpretivist	Radical humanist
Habermas' classification of interests (Mendelsohn and Gelderblom, 2004)	Technical (formal societal systems)	Practical (communication)	Emancipatory
Jackson's (2001) classification of challenges	Complexity	Subjectivity	Conflict and inequality
Goal	Efficiency of system	Understanding	Critique of method Helping the marginalised/oppressed

Table 4.1: Comparing the categorisations of systems approaches

Burrell and Morgan's (1979) four sociological paradigms are commonly used as a frame of reference in Information Systems. If the researcher categorises the systems approaches making use of the four paradigms, the following is obtained:

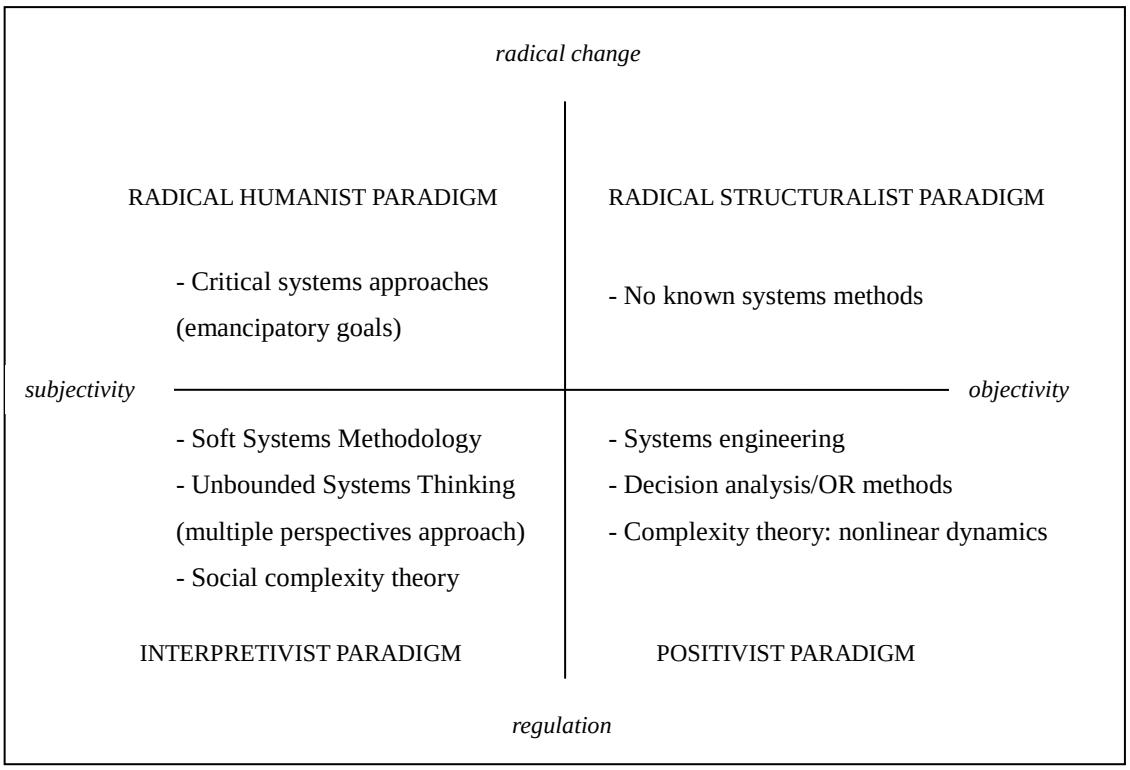

Figure 4.2: Systems approaches mapped to Burrell and Morgan's sociological paradigms

Arguments in support of the mapping in Figure 4.2 are the following:

- Checkland (1999: 280) motivates for hard systems thinking to be associated with positivism, and SSM with the interpretive paradigm.
- Jackson (2000) presents a classification similar to the above, but distinguishes between the emancipatory approaches and his own work on Critical Systems Thinking, which he regards as a meta-systems approach.

A few things about this mapping are unsatisfactory. Firstly, only three of the four blocks are used; no systems approaches have been identified which correspond to the radical structuralist paradigm. Secondly, some systems approaches do not comfortably map to an exclusively positivist or interpretivist paradigm; they contain elements of both. An example discussed in Section 3.2.5 is that of complex systems, which are self-referencing and in addition adapt to and manage an external environment. According to Alter (2004), the *nature* of systems research does not lend itself to a comfortable fit in either the positivist or interpretive paradigm (see Section 3.2.5.).

Jackson's (2003: 24) System of Systems Methodologies (SOSM) is a tailor-made categorisation framework for systems approaches. The SOSM is presented in Table 4.2. On the one axis it considers the complexity of the problem itself and on the other the level of harmony in the social environment. In the social environment, participant agreement is classified as follows: people in a unitary relationship agree on goals and values, those in a pluralist relationship differ on viewpoints and goals but may come to a common understanding about the way forward. People in coercive relationships experience directly conflicting views and goals (Jackson, 2003: 19). According to Jackson, the major systems approaches map to his SOSM as follows:

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Participant agreement</th></tr>
<tr><th>Unitary</th><th>Pluralist</th><th>Coercive</th></tr>
<tr><td rowspan="2">Type of system</td><td>Simple</td><td>Hard systems thinking</td><td rowspan="2">Soft Systems approaches</td><td>Emancipatory systems thinking</td></tr>
<tr><td>Complex</td><td>System dynamics
Organisational cybernetics
Complexity theory</td><td>Postmodern systems thinking</td></tr>
</table>

Table 4.2: Systems approaches related to problem contexts
(Jackson, 2003: 24)

The approaches developed over time from left to right: first hard systems thinking during the middle decades of the previous century, followed by soft systems approaches from the 1980s onwards, and soon afterwards the emancipatory approaches. Vertically, they have originated in the direction of 'simple' to 'complex'. New methods are appearing and existing methods are growing in sophistication across the spectrum of this table. For example, hard systems thinking is not becoming outdated but is being further developed in order to serve its problem domain better. What has changed with the addition of new kinds of approaches is the recognition that certain problem domains are better served with the newer approaches.

The temporal development of the table indicates the more recent systems research focus areas. On the one hand, there is an increased recognition of complexity and a search for appropriate

methods to deal with complexity. On the other hand, there is a continual search for more effective ways to apply systems approaches in environments of social tension.

Jackson's categorisation will be used as a basis for discussing the various types of systems approaches.

4.4 Hard systems thinking

The "hard systems thinking" paradigm, as introduced above, generally refers to approaches associated with Operations Research, Systems Analysis and Systems Engineering (Jackson, 2003: 48). Hard systems thinking follows a scientific approach to solving problems in the real-world or operational domain. According to Jackson, they replace the science laboratory experimentation environment with a set of models, often mathematical in nature, that are used to emulate reality and to decide what decisions to make. In this paradigm, optimal solutions are sought to management problems.

Two examples of hard systems thinking are discussed below, namely systems engineering and organisational cybernetics. The reason for selecting these among a number of other candidates is that they represent aspects of classic hard systems thinking. Systems engineering is a theoretical parent of Soft Systems Methodology, and has also been directly applied to social systems. Organisational cybernetics is an example of applying cybernetics principles in a social and specifically a management context.

4.4.1 Systems Engineering

Systems Engineering (SE) is one of the most comprehensive methods known in the "hard systems thinking" paradigm. The International Council on Systems Engineering (INCOSE) web site defines SE as follows:

"Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem: Operations, cost & schedule, performance, training & support, test, disposal and manufacturing" (INCOSE, 2008).

SE aims to increase the probability of success of a project, reduce risk and reduce total life-cycle cost. SE is normally used by engineers when dealing with technical systems with high fidelity requirements, although SE principles are more generally applicable and have been applied in economical, organisational and environmental systems (Turpin et al., 2005). Central to the SE process is the SE lifecycle, illustrated in Figure 4.3: The Systems Engineering lifecycle below.

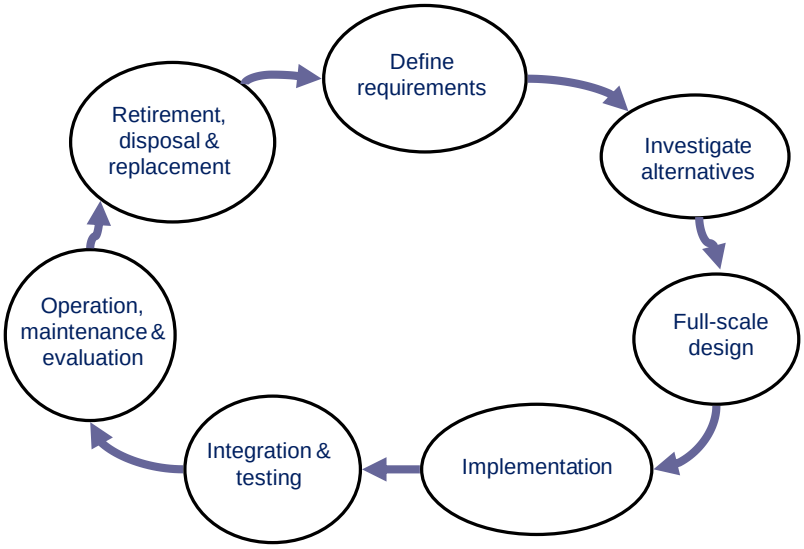

Figure 4.3: The Systems Engineering lifecycle

(Smit, 2004)

4.4.1.1 The Systems Engineering design phase

Of all the steps in the SE process, the design phase is probably its most significant contribution. Figure 4.4 below shows how system requirements are translated into several design concepts. The concepts are evaluated during a process involving the customer and by means of decision analysis. For each of the designs, a functional as well as physical decomposition needs to be performed. The decompositions are presented as systems hierarchies, or sets of interacting subsystems to be built up from basic components to the complete system.

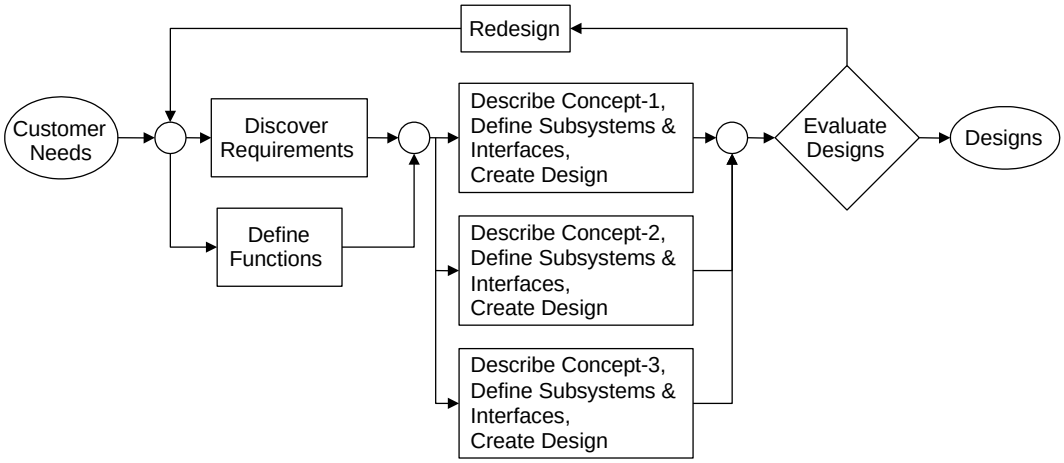

Figure 4.4: Systems Engineering: the design phase

(Smit, 2004)

4.4.1.2 The social application of systems engineering: an assessment

As mentioned, SE has been applied to economical, environmental and organisational systems. Its application to address socio-economic concerns in a developing country is rare but it has been done. Examples are Gaynor (2004) who considers socio-economic conditions in Jamaica, and Nyamvumba et al. (2011) who address policy making in Rwanda. The researcher has been involved in a project where SE was applied to investigate the poverty alleviation system in South Africa (Turpin et al., 2005). The conclusion of the exercise was that SE provided valuable insights of a systemic nature, but needed to be supplemented with methods that could better deal with the social nature of such a system, such as the differing views of multiple stakeholders. SE's strength is in the design and lifecycle support of technical systems, and on its own it is not suited as a social systems approach.

4.4.2 Organisational Cybernetics

Stafford Beer's Viable System Model is referred to by Jackson (2003) as "organisational cybernetics". Beer's attempt to deal with complexity in an organisational context is of significance: Beer has taken some fundamental systems concepts from mainly cybernetics and developed an approach that is applicable to organisations, which are social systems.

Cybernetics is defined as the science of communication and control in animal and machine. It treats a system as a black box and attempts to control it by means of negative or corrective

feedback (Jackson, 2003: 7). Initially, this thinking was only applied in an organisational context by recognising that negative feedback was necessary to help an organisation steer towards its goals. Stafford Beer, a British operations researcher, proceeded to found the field of Management Cybernetics (Rosenhead, 2006: 577). Beer expanded the applicability of cybernetics into organisations and later other social systems, by means of his Viable Systems Model (VSM). He proved the VSM to be generally applicable to all systems (Jackson, 2003: 86) and with it provided a generic method which can be used to design organisations which can survive in a changing environment (Rosenhead, 2006: 581). According to Rosenhead (2006: 578), he was concerned with the development of appropriate feedback loops into social systems, and committed to a holistic approach to complexity.

An assumption of organisational cybernetics is that there are general, nature-like laws governing every complex system. One of these laws is that complex systems have a *recursive nature*, so that "the organisational form of higher level systems can be found repeated in its parts" (Jackson, 2003: 87). This means that one can zoom in or out of an organisational hierarchy and observe the same system characteristics, whether for the organisation as a whole or a subsystem at any level. The implication is that one has to manage only one level at a time within an organisation, reducing the burden of top management and increasing the autonomy of sub-units. Another law that is recognised is the theory of autopoiesis. Beer maintains that organisations are *self-producing*, although only at the higher and more autonomous levels of operation. According to autopoiesis theory, the organisation of a system is more important than its particular structure; a well organised system could have different possible structural decompositions, all of which could be feasible. The third cybernetic law is that of *requisite variety*. In order for an operational unit to exhibit the variety required to deal with unexpected changes in the environment, it should be as autonomous as possible from the system's management structure. The management should be limited to ensuring the operational units all work towards the system goals in a cohesive way (Jackson, 2003: 88-90).

The VSM always zooms in at one level of recursion, or system of interest, at a time (Jackson, 2003). The system of interest's direct superstructure is recognised, as well as the elements of its substructure. The substructure elements are treated as black boxes but any of them could be the system of interest in another analysis. The organisation of the system of interest consists of five functions that are necessary for viability, namely *implementation*, *co-ordination*, *operational control*, *development* and *policy*. The VSM can be used to design an organisation and also as a benchmark against which to diagnose the problems in the design and functioning of an existing entity. Further, Beer has devised a set of systemic performance

measures that go beyond the usual monetary measures. According to Jackson (ibid.), VSM is usually used in single organisations, but has also been applied at a larger scale, such as when Beer was an advisor to the Allende government in Chile.

4.4.2.1 Assessment of VSM's application to social systems

A personal assessment of VSM is that although evidence has been supplied of its application to larger social systems, this is still in a very specific context, namely sanctioned organisational design, involving well-defined entities that need to be administered according to the needs of management. As Jackson (2003: 108) states, it remains a functionalist model that will not easily adapt to the other systems paradigms; it cannot accommodate the human aspects (whether in interpretive or critical fashion) to fully deal with the nature of a social system that differs substantially from a formal western organisation.

4.5 Soft systems thinking

Soft Systems Thinking, also referred to as Soft OR, refers to a number of approaches developed to deal with human and social aspects for which hard systems thinking was found to be inadequate, in particular when applied to complex problems that were messy and ill-defined and where conflicting viewpoints were held on the same issue (Daellenbach and McNickle, 2005). The two soft systems approaches described in this section are the Soft Systems Methodology (SSM) and the Multiple Perspectives Approach (MPA). SSM is the flagship of soft systems thinking. The MPA is selected because of its inclusiveness at philosophical level.

4.5.1 Soft Systems Methodology

Peter Checkland's SSM is one of the most widely researched and well-founded in terms of systems theory and its philosophical base, as well as one of the most widely used and documented (Daellenbach and McNickle, 2005).

4.5.1.1 Classification of systems and appropriate vehicles for analysis

Checkland (1999) classifies systems into four kinds:

Natural systems are the physical systems that make up the universe, from subatomic systems to the living earth. These systems follow the laws of nature and the scientific method is an

appropriate vehicle to research and analyse these systems. Natural systems provide us with examples from which we can learn more about systems and their dynamics.

Designed physical systems are the tangible systems that people have built. These systems, ranging from hammers to rockets in space, are the result of conscious design. Systems engineering is a vehicle developed to design, analyse and manage such systems.

Designed abstract systems are the non-tangible systems people have designed, such as mathematics and music. These each normally have an own "rule set" which is used to interact with such a system.

Human activity systems are the ones that have human role-players, whether as individuals or organisations. They can be socio-technical, socio-economic or social, and vary in scale from a human working with a machine to an international political system. Human activity systems differ from the other categories in the sense that there are multiple perspectives on how to understand and analyse them. Also, the human actors in the system have free wills to act, so the "operations" of such systems are less predictable.

Checkland (ibid.) later in his work mentions that a *social system* has characteristics of both a natural system and a human activity system, without discussing the matter in more detail.

Checkland developed SSM as a means to deal with human activity systems, building on the concepts of Systems Engineering as well as traditional modelling and OR methods.

4.5.1.2 The Soft Systems Methodology

SSM is a participative, facilitated process that aims to surface the various views and perceptions on a problem. It does not lead to an "objective" answer, but rather to a conclusion as agreed by participants. The outcome is not necessarily a synthesis of all perspectives. The problem-solving process is regarded to be more important than the outcome. The seven stages of SSM, shown in Figure 4.5, are discussed below, drawing on Checkland (1999: 163) and Daellenbach and McNickle (2005). Checkland makes it clear that one can improvise in the way SSM is applied, and that he regards SSM as a guiding framework rather than a recipe.

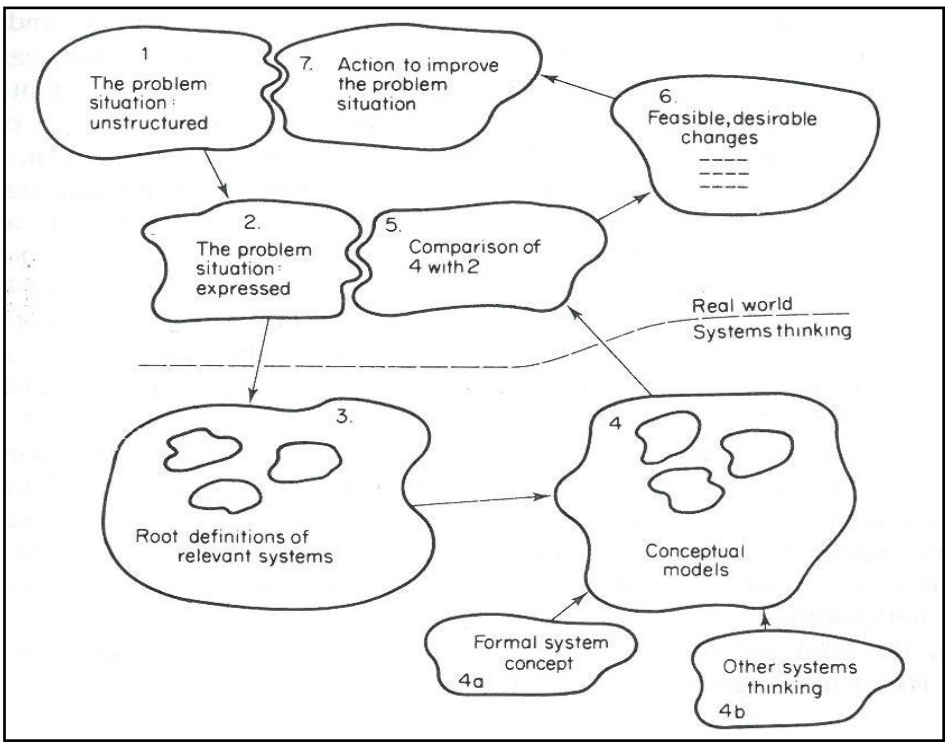

Figure 4.5: A flow diagram of the Soft Systems Methodology
(Checkland, 1999: 163)

The method alternates between "real-world" and "systems thinking" activities. Stages 1 and 2 involve expressing the situation in a rich manner, capturing elements of structure and process. Stage 3 involves identifying alternative systems related to the problem situation, and stating what these systems are, rather than what they do. Root definitions are sought for each, specifying the owners of the problem (O), the prime system transformation (T) to be achieved by the users/actors (A), the owners' world views (W) about the transformation, the customers (C) or victims/beneficiaries of the system, as well as the environmental constraints or assumptions (E). These aspects all spell the term "CATWOE" which is used as a memory aid. Stage 4 entails developing conceptual systems models based on the respective root definitions: For each view, a conceptual model is designed using the root definition as functional requirement. The activities needed for the specified transformation process to happen are first described in English verbs. Following this, the human activity systems can be more formally modelled using recognised systems approaches developed elsewhere. It might be necessary to include subsystems for monitoring and control. In stage 5, the conceptual models are compared with real-world situations. The purpose is to prepare for a debate within the stakeholder group, which takes place during stage 6. Possible changes are debated; in particular, it needs to be seen whether and which concepts are systematically desirable and

culturally feasible. Stage 7 involves taking action, by implementing the suggestions agreed upon by the stakeholders. According to Checkland, the implementation may constitute or lead to a new problem, for which the methodology can be repeated.

The systems cycle described above is viewed by Checkland as a learning cycle rather than as a lifecycle. The work being done during this process is not that of an analyst, but it is done by representatives of stakeholders. The analyst in this case is a process facilitator. It is also possible for the analyst to execute SSM as a mental exercise, by imagining him/herself in the role-players' situations (Daellenbach and McNickle 2005: 181). Daellenbach and McNickle (ibid.) note that the main challenges facing SSM are that of formulating effective root definitions, as well as the fact that there is no way of guaranteeing that role-players will reach consensus.

4.5.1.3 SSM's application to social systems: an assessment

Since SSM takes into account the nature of a human activity system, in particular recognising multiple stakeholder perspectives on a problem situation, it is well suited to application in a social domain. A comparison of the SE design process (Figure 4.4) with the SSM process reveals how Checkland has beautifully re-crafted the SE process to take into account multiple stakeholder views rather than multiple technical solutions. SSM is an interactive process, ideally used as part of action research, the way Checkland himself did (Oates, 2006: 156). Its desktop use is second prize; however, its loose assembly of sub-methods, for example its use of rich pictures to express a problem situation, and the CATWOE mnemonic to develop a root definition for a system of interest, has been found useful by the researcher on previous occasions. Of interest for this study is Checkland's statement that a social system contains characteristics of a human activity system (for which SSM was designed) as well as of a natural system.

In Chapter 2, among the ICT4D papers surveyed for their use of systems thinking, SSM is shown to be the method that has been most frequently applied or referred to.

4.5.2 The Multiple Perspectives Approach

Similar to SSM, the Multiple Perspectives Approach is also founded on accommodating different perspectives on a problem situation. Its underlying philosophy is unbounded systems thinking. The beauty of this philosophy is a key attraction of the approach; it attempts to be a truly holistic systems approach.

4.5.2.1 Introduction

The multiple perspectives approach is based on a way of thinking that Mitroff and Linstone (1993) refers to as unbounded systems thinking. This is in turn based on the philosophy of Singer, who believes in the interconnectedness of all systems and the interrelatedness of all problems. The multiple perspectives approach is an attempt to be as holistic as possible when analysing a problem, and trying to simultaneously accommodate as many views on a situation as can be found. These views are not only analytical; it also encourages the collection and analysis of organisational, personal, ethical and aesthetical perspectives.

4.5.2.2 Inquiry systems

An inquiry system is defined as "a system of interrelated components for producing knowledge on a problem or issue of importance" (Churchman, cited in Mitroff and Linstone, 1993).

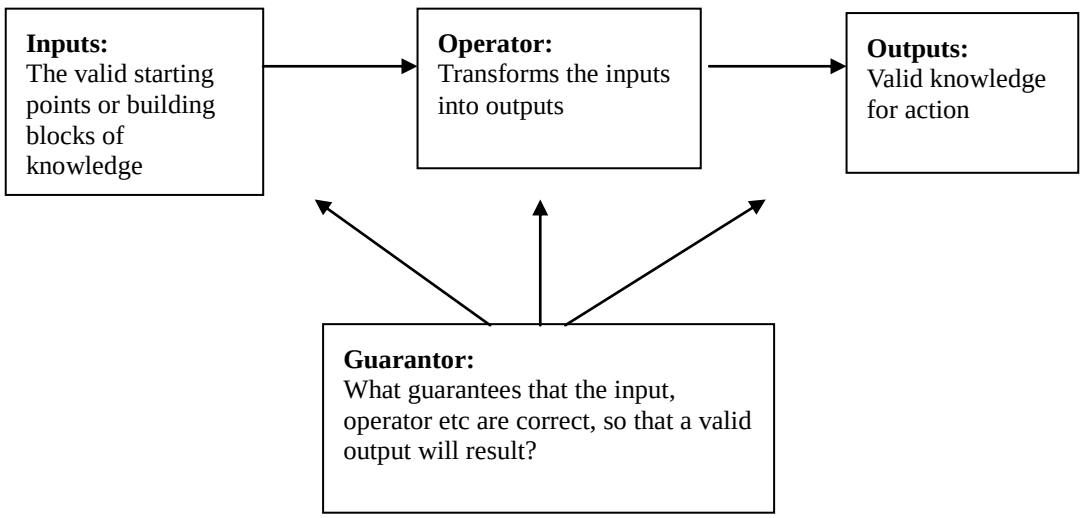

Figure 4.6: An inquiry system
(Mitroff and Linstone, 1993: 31)

The particular inquiry system used in a problem-solving exercise will determine what kind of information is being collected, how it is collected, and how the information is processed in order to arrive at knowledge which will be used as the basis for decision-making. Mitroff and Linstone (1993) discuss five types of inquiry systems[4]:

Inductive-consensual inquiry systems are designed to assist a group of experts in reaching agreement. The inputs into the inquiry system are facts, observations or the various judgements of experts. The guarantor (see Figure 4.6) would be the definition and identification of experts, since the validity of the system assumes the sound judgement of the experts, as a proxy for an objective conclusion. The operator would be something like the Delphi technique, and the output would be a consensus.

Analytic-deductive inquiry systems seek for a single best answer to a stated problem and derive that answer through rational means. Inputs are the given facts as well as axioms or self-evident assumptions. The guarantor is the set of logical rules to be applied. Rational decision-making processes fit into this category, using methods such as decision analysis, quantitative analysis or applying the rules of logic to a qualitative situation.

Multiple-reality systems recognise different views on the same problem by different kinds of experts or subject disciplines. In a multiple reality inquiry system, information and observations are not separable from the theory or model we construct of a problem. Different theories or models will collect different data on the same problem. Inputs to the multiple reality system are a range of theory/data couplings that represent various views or representations of the problem. The purpose of the inquiry is not to arrive at an answer, but to allow the decision-maker to act. The operator is not a purely mathematical one; the decision-maker will need to apply qualitative traits such as experience and wisdom in the process of generating a synthesised view.

The *dialectic* inquiry system can be seen as a variation of the multiple realities inquiry system. Two or more models are created, with views that are in the strongest possible opposition to each other. Rather than building convergence into the system, such as when the Delphi technique is used, the extremes or "outlier" viewpoints are brought to the surface. It is assumed that as a result of witnessing an intense debate between polar positions, the observer will be in a stronger position to know the assumptions of the adversaries and as a result clarify

[4] The discussion that follows is taken from Turpin (2006).

his/her own assumptions, and subsequently be in a stronger position to inform his/her own position. The output does not have to be a change in the decision-maker's position. It could also be a clarification and deeper entrenchment into the initial position, based on the consideration of the opposite(s).

The *multiple perspectives* view is based on Singer and Churchman's work (Mitroff and Linstone, 1993), which refers to the interrelatedness and inseparability of all systems. It criticises man-made categorisations, such as, academic disciplines or any limiting description of a problem or situation. Accordingly, the multiple perspectives view attempts to "sweep in" all possible perspectives from all possible professions. In particular, it needs to sweep in the previously discussed inquiry systems or problem perspectives. It suggests that perspectives can be categorised as *technical*, *organisational* or *individual (personal)* in nature. *Technical perspectives* involve the use of the scientific method. It includes the analytic-deductive inquiry system, as well as the multiple realities view. It is recommended that more than one technical view of a system is obtained. The *organisational* and *personal* perspectives are represented by including the views of as many of the role-players and stakeholders as possible. Role-players functioning in defined groups (such as companies or unions) are dealt with under the organisational perspective. Within these organisations, or separate from them, are people whose behaviour is driven by their individual needs and agendas. In as much as they act as individuals, these role-players' individual or personal perspectives are taken into account. Apart from the technical, organisational and personal views, Mitroff and Linstone (ibid.) advise that *ethical* and *aesthetical* perspectives should also be kept in mind. Even if a decision makes sense from a technical perspective, or a particular group of organisations endorses it, the decision might not be ethical.

4.5.2.3 Towards a new decision-making paradigm

Based on the multiple perspectives inquiry system as discussed by Mitroff and Linstone (1993), Courtney (2001) suggests the process in Figure 4.7 as a new decision-making paradigm. The T, O and P blocks in Figure 4.7 refer to technical, organisational and personal perspectives:

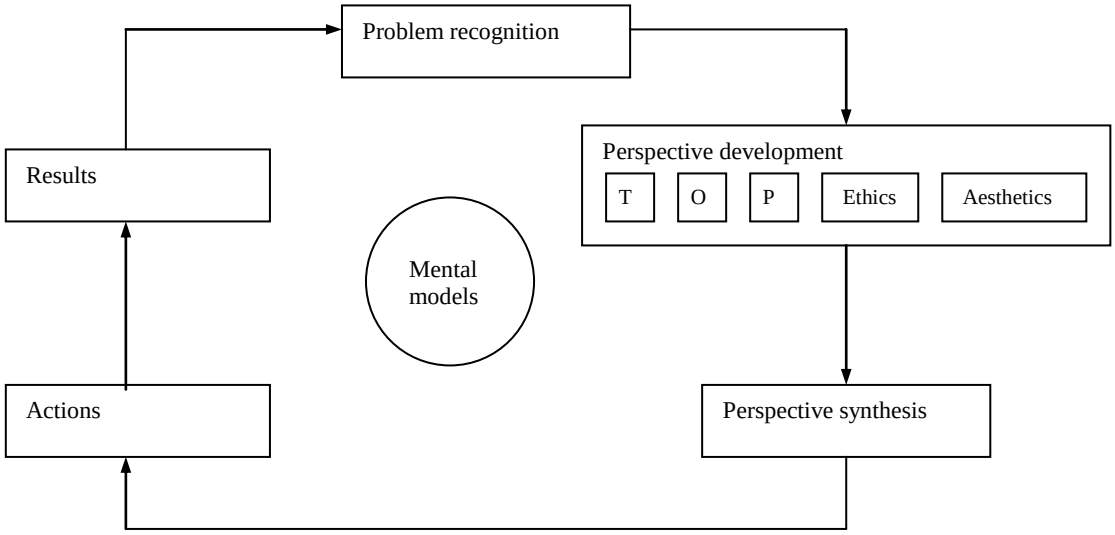

Figure 4.7: A new decision-making paradigm for DSS
(Courtney, 2001: 31)

This process is less detailed than SSM, where alternative systems concepts are designed for each major perspective and only when action plans are discussed are all options reviewed in order to arrive at a consensus action plan. On the other hand, the perspective development phase shown above is more comprehensive than what was done in the first two steps of SSM with the rich picture exercise.

4.5.2.4 Critique of the multiple perspectives approach

An attempt to apply the Multiple Perspectives Approach (MPA) on a case study at the CSIR (Meyer et al., 2007) has shown challenges in its implementation. Among the challenges was that its philosophical beauty did not translate into to a straightforward methodology for implementation. For example, it was not clear what methods were to be employed to generate an organisational perspective. The technical perspective, which covered most of the project team's already known information collection and analysis methods, was most easily understood. Generating an ethical perspective was less straightforward, not to speak of an aesthetic one. Further, how does one integrate perspectives generated from truly different paradigms? Based on the learning that took place, a suggested way of using the MPA in practice is discussed by Turpin et al. (2009). The researcher later learned of Linstone's (1984) guidelines to assist with applying the MPA, yet does not believe that many of the challenges the project team encountered could easily have been avoided.

Based on its underlying philosophy, the MPA is suited for application to a social system. However, care needs to be taken that the purpose of a systems description exercise can be practically met, since the method can become clumsy because of its philosophical inclusivity. In Chapter 2, among the ICT4D papers surveyed for their use of systems thinking, it can be seen that the MPA is referenced and at least partially applied by two of the eight papers discussed.

4.6 Critical systems thinking

4.6.1 Theoretical background

Critical or emancipatory systems thinking is aligned with the critical paradigm of social theory. The critical paradigm's origins lie in the work of the Frankfurt School, formally known as the Frankfurt Institute of Social Research in Germany which operated from 1923 onwards. This group of social theorists built on the work of Max Weber, who thought that the process of rationalisation in modern society had the potential not only to free humans but also to limit and oppress them (Gelderblom and Martin, 2005: 162). They also use the thinking of Karl Marx, who argued that capitalism is a means of oppression and exploitation of labourers. Marx advocated for labourers to organise against such oppression. Broadly speaking, the Frankfurt School aimed towards the emancipation of individuals from the dominance of societal regulation, as found in, for example, capitalism (an economic system) and bureaucracy (an administrative system).

4.6.2 Critical systems approaches: CSH and TSI

Critical systems thinking developed as a means to introduce critical social theory into systems thinking. The critical stream in systems thinking developed as a result of the work of mainly Ulrich, Flood and Jackson, from the 1970's to the 1990's. It indicates some shortcomings of other systems approaches (such as the way system boundaries are selected) and provides suggestions to deal with these. Critical approaches have a particular concern with the marginalised parties in a system and attempt to create an awareness of such parties or aspects.

According to Daellenbach and McNickle (2005), critical systems thinking is the collective term used for the two major streams of work that called for a critical approach to systems thinking. The first stream is the work of Ulrich on Critical Systems Heuristics (CSH). Its core emphasis is boundary critique. The second stream is the work done by Jackson and others at

Hull University in the 1980's, who have appropriated the term Critical Systems Thinking (CST) for their work. They attempted to create critical awareness of the strengths and weaknesses of systems methodologies, and how these related to the nature of the problem investigated. They placed specific emphasis on power relationships and wanted to put mechanisms in place to neutralise the effect of coercive power. Also included in the five commitments of CST was pluralism, on the methodological as well as theoretical level (Jackson, 2004: 281). The output of this stream that will be discussed further in a section below is Total Systems Intervention.

4.6.2.1 Critical Systems Heuristics

As mentioned, the main concern of CSH is the choice of system boundaries. Ulrich's point of departure is that boundary choices are always subjective and influenced by value systems. The choice of boundary can lead to improvements in a narrow system of interest at the cost of a worse overall system performance. A well known example from South African history is the apartheid system, where seemingly noble objectives, such as promoting the cause of poor Afrikaners, were to the detriment of society at large because of boundaries that were chosen too tightly, demographically and geographically. Since one has to choose boundaries and determine a system of interest, and there is no absolute "right" boundary, Ulrich suggests that boundary choices should always be critically examined. In the CSH approach, Ulrich poses twelve questions. The questions progress from those typically included in systems design, to questions aimed at exposing assumptions around boundaries and marginalised parties. Each has an "is" and "ought to" component. The questions concern the following (Flood and Jackson, 1991: 213; Daellenbach and McNickle, 2005: 197):

- The actual client of the system to be designed;
- The actual purpose of the system;
- The measure of the system's success;
- The decision-maker, who has control over the measure of success;
- The aspects that are controlled by the decision-maker;
- The aspects not controlled by the decision-maker, or the systems environment;
- The planner of the system;
- The experts involved with planning;
- The guarantee of the system being successful;
- The representation of those affected but not involved;
- The opportunities of those affected but not involved, to actualise their concerns; and

- The world view underlying the design, compared to the world view of the affected.

The initial questions, in particular the first three, are in their "is" mode similar to what is typically asked in other systems approaches. The last three questions, dealing with parties excluded from the system, is one of the differentiating characteristics of CSH. Another, the "ought to" mode of questions, is meant to surface assumptions, in particular, boundary related assumptions.

Midgley (1992) contributes to the CSH stream by arguing that different ethical positions lead to the choice of different boundary choices, to the extent that these boundary choices become institutionalised within groups. On a housing services project, Midlgely and fellow researchers indicated how vulnerable stakeholders could be better accommodated by the careful choice of systems design methods (Jackson, 2003: 221-226).

4.6.2.2 Total Systems Intervention

TSI is a meta-methodology developed by Flood and Jackson (1991). It is meant to critically assist in the systems intervention process. Flood and Jackson have derived principles for acknowledging TSI as a meta-methodology, aimed to deal with problem situations that are too complex and multi-faceted to be addressed by a single view or methodology (Jackson, 2003: 285). It involves the phases of creativity, choice and implementation. During the creativity phase, the following metaphors are suggested to describe the problem context (Daellenbach and McNickle, 2005):

- A machine, with a clear hierarchical structure and chain of command, exemplified by a bureaucracy or a military unit;
- An organism, with interrelated parts and sub-goals but where the primary goal is the well-being of the larger organisation;
- A brain, promoting learning, enquiry and creativity, exemplified by a learning organisation or an R&D department;
- A culture, where individuals have shared interests and interact with a community-like spirit, as in a Community of Practice or a sports club;
- A political system, where coalitions have different vested interests, such as a parliament;
- A coercive system, which is totally authoritarian, such as a prison.

During the choice phase, a systems methodology or combination of methodologies are selected. These are the ones judged to be the most suitable to the problem situation and the metaphor. The last phase is the implementation phase. Here, the chosen methodologies are used to develop and implement proposals for change (Jackson, 2003: 287).

4.6.3 Critique of the critical approaches

A weak point of TSI is that it requires thorough theoretical knowledge and experience of a wide range of other methodologies in order to add any value (Daellenbach and McNickle, 2005). Of the few people doing problem structuring, most are well versed in only one methodology. In addition, it does not guarantee that the "critical" ideals are met, such as improving judgement around boundary values. Daellenbach and McNickle (ibid.) believe that TSI is more ambitious than CSH in delivering the critical ideals, but less successful.

In principle however, it is clear to the researcher that CSH and TSI are both applicable to social systems. Their potential contribution in an ICT4D context is in the surfacing of emancipatory concerns. In Chapter 2, among the ICT4D papers surveyed for their use of systems thinking, it was found that the two papers that promote a pluralist approach (Nepal and Petkov, 2002; Turpin et al., 2009) both include critical systems thinking within such an approach.

4.7 Complexity thinking

Complexity thinking is an umbrella term that refers to a number of loosely related phenomena that were identified and studied in the second half of the 20th century. These include concepts from chaos theory, fractals and the non-equilibrium thermodynamics of open systems. Jackson (2003: 116) identifies six "key theoretical notions in complexity theory: sensitive dependence on initial conditions, strange attractors, self-similarity, self-organisation, the edge of chaos and the fitness landscape."

Edward Lorenz, a meteorologist and pioneer of chaos theory, discovered by accident that his weather forecast simulation, consisting of three coupled nonlinear equations, was extremely sensitive to initial conditions. Although this meant that the weather was unpredictable in the long term, there were interesting regularities displayed by the nonlinear equations. A pattern or trajectory was formed by the equations, never repeating itself yet returning to the same

vicinities. These vicinities are called strange attractors (Capra, 1997: 132; Jackson, 2003: 114).

The same nonlinear equations show behaviour which is called self-similarity, or fractal behaviour. Although related to chaos theory, fractal geometry was independently discovered and developed by Mandelbrot (Capra, 1997: 136). It refers to the notion that when you zoom into a graphic representation of an equation, the geometrical shapes are identical to the shapes observed before zooming in. This phenomenon can also be observed in nature, such as with the edges of clouds, mountain ranges, coastlines, as well as snowflakes and ferns.

Another significant theoretical contribution, initiated by Prigogine, was that of non-equilibrium thermodynamics. The second law of thermodynamics specifies that in a closed physical system there is a trend towards disorder, also referred to as energy dissipation, randomness or thermal equilibrium. Prigogine showed that in open chemical systems, it is possible that they can *self-organise* into a new state of orderliness and maintain themselves in a steady state or dynamic balance, far from equilibrium (Capra, 1997: 49; Jackson, 2003: 118). Lovelock subsequently showed the same for ecological systems, leading to the Gaia hypothesis. The notion of self-organisation is not to be confused with that of self-production, the latter associated with autopoiesis (Maturana and Varela, 1987).

The notion of the ‘edge of chaos’ refers to the narrow zone between order and chaos, where interesting new emergent behaviour is likely to initiate. This includes patterns of self-organisation as discovered by Prigogine. Other work in the field of complexity lead to the concept of ‘fitness landscapes’, referring to a dynamic landscape of mutually co-evolving systems, where each is on an unpredictable trajectory going through peaks of relative fitness and valleys of being disadvantaged in its stage of development (Jackson, 2003: 118).

A question with no clear answer is whether the theory of autopoiesis (Maturana an Varela, 1987) belongs in the basket of complexity theories. Jackson (ibid.) does not mention autopoiesis in his list of complexity theories. Leleur (2008), on the other hand, loosely refers to autopoiesis under the heading of complexity theories. Capra (1997: 189) discusses some commonalities between Prigogine’s work and that of Maturana and Varela. For the purpose of this study, autopoiesis is not associated with complexity theory *per se*; it is discussed and used as a separate theory.

4.7.1 Application in the systems domain: an assessment

Jackson (2003) describes various ways in which management science has appropriated the concepts of complexity, teaching managers to release their tight control and allow for self-organisation and emergence, ideally at some point at the edge of chaos. The researcher's personal assessment of these is that such application remains metaphorical. Jackson (ibid.) indicates how some of the complexity concepts have found their way into systems approaches, such as Beer's VSM which makes use of the fractal concept of self-similarity. It appears to the researcher that, of all the complexity concepts mentioned by Jackson, the concept of non-equilibrium dynamics in open systems is probably of most significance to the systems community at large. Bailey (1994) describes how von Bertalanffy incorporated Prigogine's early work into his General System Theory, stating that living systems are open systems and maintain themselves in a steady state or dynamic balance, far from equilibrium. The non-equilibrium dynamics of open systems also had a significant influence on the work of the sociologists Buckley (1967) and Bailey (1994), who each applied systems concepts to social systems.

Leleur (2008) claims that complexity theory warrants an entirely new paradigm in systems thinking, in addition to e.g. functionalism and interpretivism. He argues that complexity thinking has characteristics distinct from the other paradigms, and that enough work has been done to develop this paradigm. Jackson (2003), on the other hand, believes that complexity thinking remains in the functionalist domain, where its origins are. The researcher has not personally encountered complexity theory applications in ICT4D. In Chapter 5, which concerns the use of systems thinking in social theory, the concept of non-equilibrium dynamics is revisited when discussing the work of sociologists such as Bailey (1994).

4.8 Postmodern systems thinking

Postmodern systems thinking is listed by Leleur (2008) as a separate systems paradigm. He associates it with the third or most recent wave of systems thinking paradigms, together with the emancipatory and complexity paradigms. Its potential value will be explored as such.

All systems approaches, whether positivist, interpretivist or emancipatory in nature, can be seen to conform to the nature of modernist thinking (Jackson, 2003: 255). Modernism, which we inherited from the Enlightenment, is characterised by rationality, or reason. According to Weber, rationality is about always searching for the "most efficient, calculable and predictable

means to achieve a defined end" (Mendelsohn and Gelderblom, 2004: 11). Thus, one has a goal and then looks for a better, or the best, way to achieve it.

According to Jackson (2003: 255), postmodernism rejects all rationality associated with modernism. It not only rejects instrumental rationality, which is associated with hard systems thinking, but it also rejects communicative rationality, which is associated with emancipation and both soft and critical systems thinking. It does not believe in science as a way to grow an objective knowledge base, nor does it believe that communication can be fair and transparent and lead to consensus. Postmodernism wants to surface diversity, conflict, disorder, paradox and indeterminacy. With postmodernism being against reason and method, Jackson (2003: 261) infers that a systems approach and postmodernism do not have much in common. However, he suggests two ways in which the two can collaborate. One is to apply existing systems methods in a postmodern spirit, embracing for example pluralism, pragmatism and playfulness. Another way is to apply the approaches or tools suggested by postmodern thinkers.

As a possible postmodern approach, Jackson (2003: 261) suggests Taket and White's PANDA: "Participatory Appraisal of Needs and the Development of Action." PANDA loosely suggests a process, which can be said to resemble a traditional decision-making approach, since it contains, among other things: "defining purpose, identifying and comparing options, deciding on action, monitoring and evaluation". Of importance are the underlying values with which it needs to be applied, such as inclusivity (of participants and ideas) and improvisation. According to Jackson (ibid.), Taket and White's approach is somewhat of a recipe book from which they encourage users to mix and match, while following the value-based general guidelines.

4.8.1 Assessment of postmodern systems thinking

The researcher's conclusion from Jackson's (2003) overview is that the overall guiding values of postmodernism may be of use in the so-called post-industrial business world. These include having fun (as per the "carnival" metaphor associated with postmodernism), experimentation, questioning prevailing "grand narratives", and promoting diversity and creativity. However, the value of the postmodern methods advocated appears to be in supplementing other, more solid systems approaches. Further, the developing country context of ICT4D is far removed from the post-industrial business world, and does not contain the modernity that postmodern thinking is aimed against. Hence, it is not clear what its value will be when applied in ICT4D.

4.9 Multimethodologies

4.9.1 Context, definition and motivation

"The world has material aspects that can be measured and counted, but it also has social aspects that must be shared and understood, and indeed personal and individual aspects that must be experienced and expressed. This calls for the judicious and knowledgeable combination of a variety of research and intervention methods" (Mingers 2006: 198).

Mingers has published widely on multimethodology, e.g Mingers and Brocklesby (1997) and Mingers (2001); the latter in an IS context. Mingers's (2006) work is a recent contribution that appears to be representative of his multimethodology work, and will be used henceforth in the discussion. Multimethodology refers to the use of more than one method or methodology (Mingers, 2006: 199), particularly in the OR/management science domain. Many of the OR methods are also systems methods. Mingers distinguishes between single-paradigm and multi-paradigm multimethodology, depending on whether the methods used are from the same paradigm or not. He also distinguishes between methodology combination and enhancement. Methodology combination refers to the use of multiple methods on largely equal footing, while enhancement implies one main method enhanced by the use of other(s).

The arguments for a multimethodology approach are as follows (Mingers 2006: 199). Firstly, as per the quote above, the world simultaneously harbours material, social and personal aspects. These relate to the three worlds described by Habermas. A single methodology usually focuses on one of these worlds (depending on the goals of the project and the characteristics of the system studied) and will be blind to the other. This is because the nature of our interaction and ways of collecting information differs for each world. For example, a radar can be used to detect and measure distances to material objects, but cannot measure human experiences, perceptions and emotions. Secondly, a project or intervention usually comprises of a number of phases, each with different requirements. Mingers distinguishes between the phases of appreciation, analysis, assessment and action. The phase of appreciation will require a descriptive method, while the action phase requires a method that can be used to recommend an intervention. Thirdly, multiple methods can assist with triangulation and lead to new insights.

4.9.2 Challenges

According to Mingers (2006: 203), multimethodology also poses some challenges that need to be recognised. Methods from multiple paradigms can lead to philosophical problems if the respective philosophical assumptions are not reconcilable. However, Mingers believe that different paradigms are not necessarily mutually exclusive, and that "paradigms are permeable at the edges". Furthermore, conceptualisations such as Giddens' structuration theory that integrates the objective-subjective dualism into a duality, show that different paradigms need not be irreconcilable and can in fact enrich the philosophical grounding. A second challenge is that within one's particular discipline or community of practice, multimethodology may not be well accepted. Some paradigms are usually preferred over others, and these preferences change over time. A third challenge is that people with certain personalities may be more at ease with particular methods, and uncomfortable when having to complement these methods. For example, a highly analytical person may not be comfortable when having to do people facilitation in addition to statistical analysis. The last challenge is that of practicality. It is difficult to try and work across boundaries of philosophy, research approaches and methods in practice, and then in addition to disseminate such research to audiences who are not familiar with it. Despite the mentioned challenges, Mingers believes such work is possible, and that there is evidence of its increased application.

4.9.3 A framework for selecting methods

Mingers (2006: 219) provides a multi-dimensional framework for selecting appropriate system method(s). First, he provides a number of criteria that concern the mutual relations between the problem situation, the available approaches/methodologies and the agent(s) performing the intervention. For example, his framework considers the skill and preferences of the agents related to the available methods, the perceptions and influence of the agents related to the problem situation, and the receptiveness of the organisation representing the problem, towards particular methods. The questions are meant to stimulate continued debate and reflection among role-players, rather than being a once-off tick list.

For the framework to map methods, Mingers (ibid.) considers two variables. The first is the kind of world addressed by the method: material, personal and/or social. The second variable refers to the different phases of an intervention, namely appreciation, analysis, assessment and action. The resulting matrix is as follows:

	Appreciation of:	**Analysis of:**	**Assessment of:**	**Action to:**
Social world	Role, norms, social practices, culture and power relations	Norms, practices, culture and underlying social structures	Ways of changing existing practices and culture	Generate enlightenment of social situation and empowerment
Personal world	Individual beliefs, meanings, values, and emotions	Differing world views and personal rationalities	Alternative conceptualisations and constructions	Generate understanding, personal learning and accommodation of views
Material world	Material and physical processes and arrangements	Underlying causal structures	Alternative physical and structural arrangements	Select and implement best alternatives

Table 4.3: Framework for mapping methods
(Mingers 2006: 220)

Mingers continues to list a variety of "hard" and "soft" OR methods, ranging from mathematical programming through SSM and CSH to Drama Theory. Before mapping them onto the framework above, he classifies each method according its characteristics and philosophical assumptions, including its ontology, epistemology and axiology.

In the final step, Mingers draws a copy of the framework in Table 4.3 above for each method. The characteristics of the method are then used to colour or shade the table, for each method. One can expect the mapping for a "hard" systems method to be shaded for one or more blocks next to "material world", depending on which stages of an intervention it supports. Darker shading means the method supports the activity well. For SSM, all the blocks next to "personal world" are shaded, with the analysis and assessment blocks shaded dark.

The result is a visually accessible display of the comparative strengths of each method, per block of the framework. Of the 11 methods assessed by Mingers (2006), none have the appreciation of the social world shaded dark. The analysis of the social world is shaded dark for the methods of Interactive Planning, CSH and hypergames. (Appreciation and analysis of the social world is relevant to this thesis, which seeks to describe and analyse social systems.) Mingers concludes to say that the mapping is meant for comparison and discussion purposes rather than to be used in an absolute sense.

4.9.4 Assessment

There are clear similarities in thinking between Mingers' position on multimethodology, the MPA and Jackson's TSI. Further, the selection framework, as well as the criteria posed along with it, provides a useful way to also select single methods from the large variety of methods available, whether they are OR methods, IS research methods or systems approaches. Few researchers or practitioners have the general knowledge of their field that is required to do a method comparison such as presented in Mingers (2006). Therefore, an existing comparison such as Mingers' is useful, although it remains generic and does not take the detailed requirements of a particular project into account.

What makes Mingers' contribution attractive is that it recognises the same philosophical inclusivity as the MPA and TSI, but makes suggestions that are more practical than that of the MPA, for selecting appropriate methods. Further, the selection criteria suggested by Mingers above appear to have benefit for this study. These criteria are revisited in Chapter 5, when developing criteria for selecting a social systems approach.

4.10 Conclusion

This chapter presented an overview of the characteristics of systems thinking, as well as different kinds of systems approaches, in the search for an approach to describe social systems in ICT4D. From the introduction and overview of systems thinking, useful concepts or ways of applying systems thinking in ICT4D have been identified.

For each systems approach discussed, an assessment was made of its applicability to social systems, keeping in mind the ICT4D context. While even systems engineering has been applied in a social context in developing countries, it has been assessed to not be a suitable approach for this study unless it forms part of a multimethodology. The soft and critical systems approaches are more suitable candidates, with SSM already having a track record in ICT4D. The work on multimethodologies by Mingers (2006) was argued to be not only helpful when attempting to combine methodologies, but also to assist in selecting individual systems methodologies, such as for this thesis, where a descriptive/analytical approach is sought to be applied to social systems.

Before making a decision on a suitable systems approach, or combination of approaches, the second half of the research question below needs to be considered. It deals with social theories that apply systems thinking, and will be discussed in Chapter 5:

- How does the literature approach social systems, from systems thinking and from social theory perspectives?

The combined conclusions of Chapters 4 and 5 will be used to determine criteria for selecting a systems approach, as well as to suggest an approach.

Chapter 5 Social theory building blocks, and selecting a social systems theory

5.1 Introduction

In this chapter, the search continues for possible systems theories or approaches to describe the social context of an ICT4D project. A journey is made through social theory, considering its use and application of systems thinking. In doing so, the second part of the following research question is addressed:

- How does the literature approach social systems, from systems thinking and from social theory perspectives?

Not only have systems thinkers attempted to extend systems concepts to social settings; social theorists have also incorporated systems thinking in some of their work. The knowledge base and departure point of the social theorist is firstly that of the social setting. They are domain experts applying a method sourced from systems theory, whereas systems thinkers are method experts applying their method to a new domain. Whereas the sociologists' understanding and application of systems theory might be selective, their understanding of the social setting is important to the study of social systems. If the study of ICT4D's social context is to be taken seriously, then the recognised knowledge domain for studying the social setting needs to be considered, namely sociology. Since the search is for a social systems theory, only social theory that appropriates systems thinking is surveyed.

Similar to what has been done in the previous chapter, a historical context of how systems thinking has influenced social theory is provided in Part I of this chapter. The historical overview commences with the mechanical social systems view that arose during the seventeenth century. This is followed by an introduction to functionalism and its major proponents. Other, more recent systems-related contributions to social theory are subsequently discussed. A separate section is dedicated to the social theory of Anthony Giddens. It summarises his thinking around social systems and also discusses structuration theory. Structuration theory is the social theory that is taken further into the systems framework of this thesis, for data collection and analysis. Although the motivation for including structuration theory in the systems framework only follows later, the theoretical background on structuration theory is placed in this chapter, along with the other social

theories presented. Following the discussion of the individual social system theories, an assessment of the theories is presented in a single section.

Having concluded a discussion on systems theories (in Chapter 4) as well as on social theory using systems thinking, the time arises to select an appropriate theory/approach, or combination of approaches, to develop into a systems framework for the study. This matter is discussed in Part II of this chapter, and contributes to the research question:

- What is an appropriate social systems framework with which to study the impact of an IT intervention on a remote, rural African community?

In the discussions below, differences may be noted between the use of systems concepts by sociologists and the terminology used in the previous chapter on systems approaches. This chapter is based on the writings of sociologists. For example, where biological principles are used, von Bertalanffy's thinking may feature strongly in the writings of systems theorists whereas sociologists will refer to Parsons' appropriation of biological principles. Also, the term 'functionalism' appears frequently in social theory discussions related to systems thinking, but the term seldom appears in the systems literature. Another difference is that in systems literature, reference is made to systems thinking, systems methods or systems approaches while the social theory literature may refer to a systems theory.

Part I: Social theory building blocks

5.2 A mechanical view of society

One of the earlier system-related views of society, the mechanical view, can be traced back to the age of modernity. The age of modernity is characterised by rapid advances in the fields of physics, mechanics, mathematics and astronomy during the seventeenth century. Newly acquired analytical thinking and approaches were also applied to the human and social domain, giving rise to "social physics", which viewed humans as intricate machines (Buckley, 1967: 8; Dahlbom and Mathiassen, 1993: 14). Also, a "social mechanics" view arose that saw society as an astronomical system, applying laws of mutual attraction and concepts such as space, equilibrium, forces, energy transformation and the like. According to Buckley (ibid.), some, but not all of the work done in this stream, has made a valuable contribution to social science. He singles out Pareto's "rational mechanics" of the late nineteenth century as a meaningful contribution (Buckley, 1967: 8). Although not always in as strong and explicit a

format, the mechanical world view has prevailed and remnants of this view are still present in metaphorical speech.

In the previous century, another rapid development in analytical and mathematical methods occurred around World War II, giving rise to the field of Operations Research, the principles of which found their way into management science, and as such into the social domain. As discussed in Chapter 4 when introducing systems thinking, the direct application of these analytical principles to the social domain is referred to as "hard systems thinking". Hard systems thinking is another manifestation of a mechanical world view.

5.3 Functionalism

5.3.1 Biological models in the social domain

The use of the organism analogy in sociology is widespread (Buckley, 1967: 11). According to Buckley, the central principle of the organism view is the mutual dependence of the components of a system. This principle is shared with the mechanical view of society. Although functionalism is the most prominent stream within the organic or organismic mode of thinking, not all use of biological models can be labelled as functionalist. Examples of organism-related social theory contributions not associated with functionalist thinking are those of Spencer in the late nineteenth century, and Ward in the early twentieth century (Buckley, 1967: 11-13). According to Buckley, Spencer was careful in applying biological analogies but it was unfortunate that he chose to associate society with an individual organism rather than to a species. Ward selected the species analogy, and his work can accordingly be associated with a stream called Social Darwinism. Whereas the organism analogy focuses on the cooperation between parts of society, the Darwinist model emphasise competition among parts (Buckley, ibid.).

5.3.2 Functionalism: an overview

The bulk of systems thinking found in social theory can be classified under the heading of functionalism. Prominent classic and modern social theorists who made use of systems concepts in the functionalist tradition, are Auguste Comte, Emile Durkheim, Talcott Parsons and Robert Merton (Giddens, 2001: 16). Comte (1798-1857) was one of the founding fathers of sociology. He had a positivist inclination, wanting to study society as one studies the natural world, and this view went along with his use of systems concepts. Comte had a strong

influence on the writings of Durkheim (1858-1917), who in turn influenced Parsons (1902-1979) and Merton's (1910-2003) work in the twentieth century (Giddens, 2001: 16). Functionalism's heydays were in the 1940s and 1950s, when it was the dominant social theory in America (Haralambos and Heald, 1985: 521), predominantly on the strength of Parsons' contribution.

Functionalists use systems concepts from biology, comparing the functioning of society to that of an organism. Social institutions, such as the family, religion or education, are viewed as interdependent subsystems of society in the same way that the heart, lungs and nervous system are interdependent. Society, similar to an organism, has certain basic needs that must be met for the sake of its continued existence. Social institutions are meant to fulfil these needs (Haralambos and Heald, 1985: 522). For example, the family fulfils the societal needs of sexual reproduction and the socialisation of new members; these are termed the *functions* of the family. One of the challenges experienced by functionalist researchers is to identify the functions of particular subsystems, since one cannot isolate or remove societal institutions experimentally as one can a biological entity's organs.

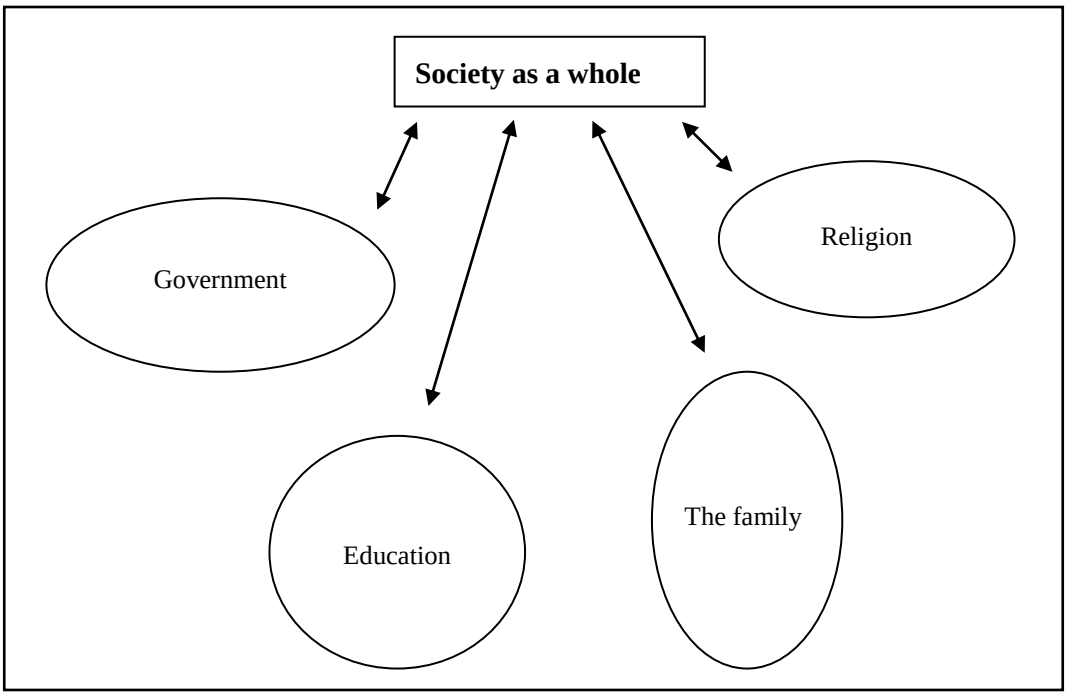

Figure 5.1: Society, with some of its social institutions

Figure 5.1 indicates some of the social institutions which form part of society. As indicated by the arrows, the relationships and functions studied by the functionalists are those between individual institutions and society as a whole.

The functionalist view is teleological. Ultimate goals are assumed for the social system or society as a whole, namely its survival, continuity and orderly existence. The value of social institutions is seen in their contribution towards these goals. Haralambos and Heald (1985) criticise this teleological view, arguing that it ends up confusing effects for causes. That is, what an institution *does* is regarded as a basic *need* of society: if an economic system leads to social stratification, functionalists will argue that social stratification is a requirement of an orderly society.

Another distinguishing factor of functionalist thinking is the striving towards balance, order and moral consensus (Giddens, 2001: 16). A properly "functioning" society is considered to be an orderly one. Functional institutions or practices are those that help maintain an ideal state of equilibrium in the society, namely a stable version of the status quo. A disruptive activity or practice is viewed as a dysfunction. Functionalists have concentrated positively on the functions within society rather than dysfunctions (Haralambos and Heald, 1985: 524).

From Turner (1991), it appears that the thinking underlying functionalism, being teleological as well as normative in its striving for social cohesion and shared values, has been deeply influenced by the Christian religion. Parsons grew up as a reformist Protestant which directly impacted his thinking. Similar to (and influenced by) Weber and Durkheim before him, he was personally interested in the role of Christianity in shaping western capitalist society (Turner, 1991: xxi).

In the sections that follow, the views of some leading social theorists who contributed to functionalist thinking will be briefly investigated. These people have not only influenced our modern day thinking around social systems, but also produced the grounds for criticism against functionalism and associated concepts such as structuralism and teleology.

5.3.3 Durkheim's use of systems concepts

Durkheim believes that society has an existence independent of its human actors (Haralambos and Heald, 1985: 524). The system of society is constituted of social facts, or beliefs and moral codes. Social facts, rather than individual consciousness, direct and constrain human

behaviour. The origins of social facts are the social facts preceding them, and the way they are appropriated and passed on between actors depends on their usefulness.

According to Durkheim (cited in Haralambos and Heald, ibid.), the system of society has certain functional requirements, and the most important one is social order. A society without cohesion and social order will fall apart. Thus, social facts that assist in maintaining social order, such as shared values, are useful to the continuance of society. As an example, the institution of religion has functions which are useful as social facts. These include uniting people by means of a shared faith, providing a sense of belonging, reminding people of their social duties, and instilling a shared set of values (Haralambos and Heald, 1985: 526).

5.3.4 Parsons' functionalism

Talcott Parsons is one of the most influential contributors to modern sociology, and simultaneously one of the most criticised (Turner, 1991: xviii). Reactions to his work include Giddens' structuration theory, much of which was developed in reaction against Parsons' views, and the neofunctionalist stream of social theorists who simultaneously accept particular criticisms against Parsons' work and defend it in general (Bailey, 1994: 8). According to Turner (ibid.), two major influences on Parsons' work were his Protestant background and his personal interest in biology and medicine. Parsons' theory of human action is value-based, while his views on social structure are systems-based, with a biological /organism grounding.

Parsons argued that the dominant rational view of society in his time did not explain social order and cohesion. If all humans were selfish, rational, economic beings, this would not necessarily lead to social order and harmony. The basis for order is shared values; this is necessary for unity and cooperation (Turner, 1991: xxix; Haralambos and Heald, 1985: 527). Shared values imply common goals, and attaining these goals requires cooperation. In practice, specific roles are needed to work towards such goals. Combinations of roles are found in social institutions. Each role is accompanied by a set of norms that provide a code of conduct, such as for a medical doctor or a parent. It can be seen that Parsons' society is guided by shared values at all levels. According to Parsons, social values become institutionalised, and this leads to a stable system that displays a state of "social equilibrium". Equilibrium is maintained in two ways: by the socialisation of new members via the family and education systems, and by social control.

Parsons' societal system has four main functional prerequisites (Haralambos and Heald, 1985: 528). These functions need to be institutionalised for society to continue effectively. They are summarised by the AGIL acronym: adaptation, goal attainment, integration and latency or pattern maintenance. Adaptation refers to people's need to survive within and control their environment. Institutions that capture this requirement are the economic and industry-related ones. Goal attainment refers to the need to develop joint goals and strive towards them. Government and political institutions help in setting goals and allocating resources. Integration is about the management of internal conflict. The legal system assists in this. Latency or pattern maintenance refers to overseeing the joint value system. The fiduciary system, including institutions of education, the family and religion, fulfils this function. All of these subsystems work towards stability, although change does occur and is explained as follows. Changes that are necessitated in one subsystem, possibly by a changing environment, produce responses in other subsystems in a way that tends toward a new equilibrium.

In a modern society, where individual institutions become increasingly more specialised and differentiated, social integration becomes more of a challenge. Again, Parsons turns toward the shared value system to resolve this issue. He argues that the values that successfully maintain such a system are more generalised and diffused ones, not closely linked to a particular culture or religion. These are values such as universalism and achievement (Haralambos and Heald, 1985: 530). The difference between traditional and more modern societies can be characterised by different sets of "pattern variables", with universalism, achievement and affective neutrality being some of the pattern variables that characterise modern society, compared to traditional society's respective pattern variables of particularism, ascription and affectivity (Thomas and Noble, 2004: 89).

5.3.5 Merton's contribution

Merton, a contemporary of Parsons, presents three criticisms against assumptions commonly held by functionalists (Haralambos and Heald, 1985: 530). As such, his contribution is towards a more nuanced application of functionalism with a more careful treatment of generalisations. Firstly, he has a problem with the notion that each subsystem contributes functionally to the entire social system, or "functional unity", especially in the case of complex and highly differentiated societies. For example, in a society with multiple faiths, religion may in fact divide rather than unite. Also, some subsystems may be relatively autonomous so that their functionality is not available to the rest of the system. Second, Merton (cited in Haralambos and Heald, ibid.) argues against the assumption that all

institutions make a positive functional contribution to society. Rather, one needs to assume that a subsystem may be functional, dysfunctional or non-functional. In addition, one needs to ask: functional to whom? He gives the example of poverty, which is dysfunctional to the poor but may be functional to the non-poor. Merton's third criticism is against the notion that some institutions are indispensable to society. This assumption is often made for religion or the family. He suggests that communism, for example, may to some people provide a functional substitute for religion.

Merton argues that functional analysis should start with an investigation into the "effects" of social institutions, regarded with a more open mind. This will remove the ideological, value-based prejudice for which functionalism is criticised. Although Merton is critical of some aspects of functionalist thinking, he is still referred to as a functionalist, e.g. by Giddens (2001) and Haralambos and Heald (1985).

5.3.6 A critique of functionalism

Haralambos and Heald (1985) raise four areas of criticism against functionalism. The first one is its teleological view. As mentioned before, this could result in confusing effects for causes: if an institution displays certain characteristics (its effects) that are regarded as beneficial to the social system as a whole, it is assumed that the system exists because of these characteristics or contributing functions. This is a logical problem, since effects cannot precede causes. A more sound way of analysis would be to consider the effects of an institution, as argued by Merton, with the assumption that the institution continues to exist because it is doing something beneficial to society. In biology, the contribution of an organ can be assessed by the fact that the organism dies if the organ stops working. However, "societies change rather than die" (Haralambos and Heald, 1985: 532). Also, there are agreed upon measures for an organism's health, but nothing similar for a society. (Personal comment: Haralambos and Heald ignore substantial work that has been done on wellness measures and indexes, such as the Human Development Index, although there is also controversy around some of these). One cannot conclude that an institution has a beneficial effect on society as a whole, just because the institution as well as society continues to exist. The arguments above indicate the problems that arise when trying to use an organism analogy to study society.

The second concern with functionalism is the importance attached to value consensus. Haralambos and Heald (ibid.) provide examples to show that value consensus is neither a necessary nor a sufficient condition for an orderly society. A variation in values could enable a

stable social stratification, and consensus on values that are extremely competitive or counter to human rights could be destructive. They argue that the content of values (such as values that promote harmony) rather than value consensus, is important for social order.

Functionalism is also criticised for the view that social life is determined by the social system: humans are "programmed" according to the norms and values of the system during socialisation, they are kept in line by means of social control, and assigned roles in institutions that meet the requirements of society. The social system is elevated to an external and very powerful actor that structures human life. The counter-argument is that humans shape their own social world.

The fourth point of criticism by Haralambos and Heald (ibid.) is that functionalism underplays existing conflict, instability and disorder that are integral to a system where power and resources are distributed unequally, as in reality it always is. Conflict is not merely a symptom of a value consensus that is not well enough exercised.

Buckley's (1967) main criticism against functionalism is a point he raises against all biologically-inspired organism analogies in social theory. According to Buckley, the main difference between a social system and an organism is the social system's ability to continually and rapidly adapt and change: "it is change rather than stability we must account for" (Deutsch, cited in Buckley 1967: 15). Societies can entirely change their structure, and change into new but stable states. Biological approaches are interested in studying self-regulation based on the concept of homeostasis, which allows for very limited change and a return to previous states. Buckley argues that it would have been more appropriate to liken society to a collection of organisms (a species, or ecological system) than to an individual organism. The flexibility in the arrangement of components of a species or ecology more closely resembles that of a human society.

According to Buckley (ibid.), functionalism is worse than other biological models, because it over-emphasises stability and order, thus making it even less suitable to represent the dynamic nature of a social system.

5.4 Other systems contributions in social theory

A selection of other systems-related work in social theory, many of which developed in response to functionalism, is presented here. General overviews of systems thinking in social

theory are found in Buckley (1967) and Bailey (1994), who also propose approaches they personally favour, typically as alternatives to functionalism. The discussion below indicates a variety of ways that systems concepts have been used in social theory, and does not claim to be comprehensive.

5.4.1 The work of Buckley

Buckley (1967), in "Sociology and Moderns Systems Theory" presents an in-depth study of the use of systems concepts in sociology to that date. Buckley reacts against mechanical and biological systems views used in the social domain, and in particular against functionalism. He promotes an alternative social systems approach based on principles from general systems theory and cybernetics. Buckley also uses concepts associated with complexity theory.

According to Buckley, a social system differs from a biological one in its variability and adaptability; it continually changes its structure in response to external or internal conditions (Buckley, 1967: 18). Buckley views society as a complex adaptive system that uses internal feedback processes to adapt its structure, in order to better survive in a fast-changing and turbulent environment (Mingers, 2006: 169). Not only does the organisation of the components change, but the parts themselves are altered while they participate in the system's activity (Buckley, 1967: 46). Mingers criticises open, information processing systems views, such as Buckley's, for placing the system and it parts at the mercy of the environment, as if it were the environment that determined the system (Mingers, 2006: 169). Nevertheless, Buckley presents an alternative to functionalist thinking that better accommodates aspects of the social nature of a social system.

5.4.2 Giddens and Luhmann's use of systems concepts

Giddens, from the 1970s onwards, criticised the biological view as limiting and from his structuration theory gave a new definition to social systems. Another prominent sociologist who applied systems thinking is Niklas Luhmann. Luhmann integrated a variety of theories in his work, including those of Parsons (so that Luhmann is mentioned together with neofunctionalists in Turner (1991: xix)), Husserl's phenomenology, von Foerster's second-order cybernetics, Spencer Brown's calculus of distinction, as well as Maturana and Varela's concept of autopoiesis, or self-producing systems (Seidl and Becker, 2006: 10). Luhmann believed that communicative acts form the basis of the societal system (Scott and Marshall, 2005: 656). The work of Giddens and Luhmann is discussed in more detail elsewhere in the

thesis: Giddens later in this chapter and Luhmann in Chapter 6 that deals with autopoiesis, since Luhmann's work draws heavily on autopoiesis theory.

5.4.3 Alexander's neofunctionalism

Alexander coined the term "neofunctionalism" in 1985 to emphasise a simultaneous critique and continued application of Parsons' thinking (Bailey, 1994: 8). Alexander (cited in Bailey, ibid.) admits as problematic Parsons' positions on equilibrium and order, as well as his normative and teleological thinking. At the same time, Alexander argues that contemporary social theorists, even non-Parsonians, often return "to some core elements in Parsons' earlier thought" (Alexander and Colomy, cited in Bailey 1994: 8). These include Parsons' theories on "action and order, conflict and stability, structure and culture" (Bailey, op.cit.). Alexander attempts a synthesis between functionalist theory and subsequent social theory.

5.4.4 Graaff's overview

Romm and Sarakinsky's (1994) volume on social theory contains a chapter on systems thinking in sociology by Graaff (1994). Graaff presents an introduction to the topic based on Buckley's (1967) views. Graaff (1994: 209) proceeds to claim that the "important contemporary social theorists who have taken up systems theory" are Habermas, Luhmann and Giddens. Graaff provides no grounds for this claim and does not mention Habermas or Luhmann again, although he mentions a few instances where Giddens makes reference to systems. Graaff (ibid.) continues with an analysis of the systems thinking in the World System Theory developed by Immanuel Wallerstein in the 1970s. Graaff's conclusion is that although Wallerstein's theory has benefited from systems concepts, it is not exemplary in its use of systems thinking. "World system theory is a theory of the world system without a system theory" (Pieterse, cited in Graaff, 1994: 206).

It is not clear why Graaff chose Wallerstein's work to analyse, especially since he has nominated three other candidates for their contribution. Regardless, Graaff presents a valid and accessible critique of World System Theory, which by virtue of its name could be mistaken for a systems theory in the social domain.

5.4.5 Bailey: promoting recent systems thinking to sociologists

Kenneth Bailey provides an overview of systems thinking applied in sociology, as at 1994 (Bailey, 1994). While Buckley (1967) presents "modern systems theory" to his readers, Bailey

is excited about the "new systems theory", referring to developments that occurred since the 1960s, and in particular since Buckley's overview. According to Bailey, social systems theory had by the 1990s outgrown the functionalism that first characterised it. Bailey promotes three relatively recent systems theories that have the potential to make a contribution to social science, namely social entropy theory (Bailey's own social systems theory), living systems theory (the work of James Grier Miller) and autopoiesis (Maturana and Varela's theory). According to Bailey, these theories each in their own way deal with important societal processes, such as entropy, self-production, matter-energy processing, information processing as well as control processes, more effectively so than existing social theory is able to do. As opposed to early mechanical and biological systems thinking that emphasises equilibrium (as does functionalism), these theories have all progressed beyond assumptions of equilibrium.

The three theories that Bailey promote are discussed below. Although only one of these is his own theory, the overall discussion relies heavily on Bailey's (1994) monograph, and as such, the theories are discussed under Bailey's name. Autopoiesis is discussed in more detail elsewhere and also taken further into this thesis' systems framework.

5.4.5.1 Living systems theory

James Grier Miller was a qualified psychologist and psychiatrist, and regarded as the "father of the American clinical psychology movement" (Swanson, 2006). However, his living systems theory, published in 1978, was developed as part of an interdisciplinary research endeavour that involved an esteemed systems scholarship group (Bailey, 1994: 168).

Living systems theory "was built upon a search for the common properties of *all* living systems" (Bailey, 1994: 171). Bailey terms it a general systems theory, which claims that living systems are open systems, processing matter-energy and information, while maintaining a steady state of negative entropy (relative orderliness). According to Miller's theory, all living systems are composed of twenty subsystems, these classified according to whether they process matter-energy, information, or both. (The two subsystems processing both are the "reproducer" and the "boundary" subsystems.) Although the subsystems serve different functions, Miller steered away from using the term "function" and the accompanying functionalist assumptions. Each subsystem has a clear role that can be associated with system input, processing and output. Living systems also occur at eight different levels: the cell, organ, organism, group, organisation, community, society as well as supranational systems. At each level, the living entity is composed of the entities at the previous level, from which it has

evolved. Also, each level has emergent properties that cannot be reduced to the system properties at the previous level. For each of these 8 levels, its 20 subsystems take on a different nature, that can be presented in a 8x20 matrix. For example, the "reproducer" subsystem of a cell is its DNA and RNA molecules, the organism's is its reproductive organs, the society's is the convention that writes its constitution, and the supranational system's is the United Nations (Miller, cited in Bailey, 1994: 182). Practical applications of living systems theory include a major study involving the US army, as well as studies of the family and small groups (Bailey, 1994: 207).

According to Bailey (1994, 2006) the contributions of living systems theory include the following. The identification of the 20 critical subsystems (required "functions" of all living systems) makes the theory comprehensive, as other systems models generally only include a subset of these. The identification of the 8 hierarchical systems levels is a major cross-disciplinary achievement. Most academic disciplines limit themselves to only one of these levels. The exact number of subsystems and hierarchical levels are not of importance, since some of them could be collapsed or expanded; of importance is the spectrum that they cover. A further contribution is that Miller makes it possible to identify concrete systems at each level, and concrete examples of subsystems, on which hypotheses could be tested. This is in contrast with Parsons' work, which remained at a more abstract level. Also, Miller included in his analyses less straightforward concepts such as physical space and time, information processing, matter-energy processing, and entropy. Bailey (2006: 296) states that "living systems theory clearly represents the most comprehensive analyses of living systems ever made".

The publication of Miller's theory in 1978 had a largely positive reception. However, Boulding implied that the theory had an overly biological emphasis, and Parsons admired the thoroughness of Miller's approach but wished him to have rather focused on abstracted systems (Bailey, 1994: 208). The major limitation of Miller's theory was his decision to shy away from values and similar subjective aspects and to regard these as outside the realm of science. According to Bailey (1994: 210) this is the weak point of living systems theory when relating it to sociology. Other limitations mentioned by Bailey (2006) are projects that Miller did not complete, namely his wish to quantify the theory, and to develop abstract concepts to complement the concrete focus of the theory.

In comparing Miller's thinking with other social systems theories, Bailey (1994: 213) claims that there is not much in common between living systems theory and functionalism or

neofunctionalism. He does find compatibilities with Giddens' structuration theory, such as in the treatment of time and space. Where it differs from Giddens' thinking, it is not contradictory.

5.4.5.2 Social entropy theory

Social entropy theory (SET) was published by Bailey in 1990 and pertains to human systems in particular (Bailey, 1994: 164). According to Bailey (1994: 219), it was inspired by an in-depth study of functionalism. Bailey recognised the need to depart from functionalism's equilibrium-based thinking, and to develop a social systems concept that could more adequately represent a complex society.

The equilibrium-based thinking of functionalism is challenged by the notion of entropy. The concept of entropy was initially captured by the second law of thermodynamics, which specifies that, in a closed physical system, there is a trend towards disorder, also referred to as energy dissipation, randomness or thermal equilibrium (Capra, 1997: 47). Based on Prigogine's work in 1955 on entropy in open systems, Bertalanffy in his General System Theory states that living systems are open systems and maintain themselves in a steady state or dynamic balance, far from equilibrium. This dynamic balance is associated with low entropy, and a dynamic orderliness (Capra, 1997: 49; Bailey, 1994: 150). Bailey (ibid.) spends considerable effort in developing the theoretical basis of a social systems construct that accommodates non-equilibrium thinking (social entropy) as well as equilibrium.

From Bailey (2006) it appears that SET is an extension of living systems theory, and aimed to complete Miller's unfinished task of developing key systems variables. Bailey developed six macro-sociological variables, namely "population size (P), information (I), level of living (L), organization (O), technology (T) and space or territory (S)" (Bailey, 2006: 297). Bailey later adds energy (E). The EIPLOTS variables jointly describe the state of a social system, including its entropy. These variables could be applied to any of Miller's eight system levels and forms the basis for quantification. Bailey (2006: 299) claims that the first four variables in EIPLOTS directly measures entropy. Zero levels for energy, information, population and level of living would indicate the system's death, i.e. maximum entropy. For the sake of the human system, entropy needs to be kept low by the 20 subsystems of Miller.

5.4.5.3 Autopoiesis

This paragraph deals with Bailey's motivation of applying autopoiesis theory in the social domain. The principles of autopoiesis, a biological theory of self-producing living systems, are introduced and discussed later, in Chapter 6. The reason for keeping Bailey's discussion here, is because he recognised the potential merits of the theory as a sociologist, and the discussion belongs as part of a social theory perspective on systems approaches.

According to Bailey (1994: 285), "autopoiesis is one of the most exciting new notions in systems theory in particular, and in social and behavioural science in general". Bailey regards autopoiesis to be "a highly sophisticated model developed in the best sense of classical systems theory", and also finds appeal in its epistemology (which emphasises the role of the observer) as well as its hermeneutic, interpretive and non-functionalist approach. Bailey identifies as problematic the inaccessible terminology and writing style of Maturana and Varela. He argues that these are hindrances which have prevented the wider spreading and acceptance of autopoiesis.

Bailey sets out by trying to present autopoiesis terminology and concepts in an understandable format to his readers. Following this, he compares these concepts with systems concepts from living systems theory and social entropy theory, looking for similarities in thinking. From this comparison, he shows that living systems theory, which allows for concrete reproduction at all system levels, may be able to support an argument that social systems are autopoietic. Bailey spends some effort in trying to address the question of whether social systems are autopoietic, which he claims is not a straightforward matter at all (Bailey, 1994: 292). Bailey highlights the dilemma of trying to directly transfer a biologically defined physical component production process to social systems. Of the various views and contributions towards social autopoiesis, Bailey favours Luhmann's redefining of autopoiesis in the abstract domain, based on communication. When comparing autopoiesis to existing mainstream sociological theory, Bailey singles out Giddens' structuration theory as having parallels with autopoiesis. He does this on the strength of Mingers' (1989) claims of compatibility between the two theoretical notions. However, in 1989, Mingers' ideas on the fit between structuration theory and autopoiesis were still preliminary; they were only developed further after Bailey's publication.

In the light of the lack of consensus on whether autopoiesis applies to social systems, Bailey is carefully optimistic about the value of autopoiesis to sociologists. He regards concepts such

as recursive self-production and structural coupling as promising, and concludes that the exploration of the social application of autopoiesis is worth further attention.

5.5 Giddens and social systems

Giddens' structuration theory and his related views on social systems are introduced here. Giddens' work is voluminous and full of nuances which are difficult to do justice to in a summary. The section that follows attempts to present the basic ideas related to structuration theory, and their implications for systems thinking as developed by Giddens. It also attempts to surface the similarities between autopoietic or self-producing systems and Giddens' social structuration, which will be returned to when dealing with social autopoiesis.

The key sources for the summary below are Giddens (1984) and Mendelsohn and Gelderblom (2004). The latter is the study text of a social theory module, for students majoring in sociology. It is based on a range of Giddens' publications on structuration theory, as well as a number of commentaries on Giddens. As such, Mendelsohn and Gelderblom (2004) cover a wider spectrum of Giddens' work than what is contained in his 1984 publication.

5.5.1 Background: Structuration theory

According to Giddens (1984: xiii), Parsonian sociology and in particular functionalism came to dominate sociology internationally after World War II. During the late 1960s and early 1970s, many alternative theories came to the fore or received attention by sociologists, including symbolic interactionism, phenomenology, the critical theory of the Frankfurt school, hermeneutics and language-centred philosophy. Although there was a broadly interpretive tendency among them, there was an overall disarray of thinking with no single contestant to take the position that functionalism used to occupy. Giddens wanted to step in and sort the disarray. Of primary concern to Giddens was the schism that developed between subjectivist and objectivist schools of thought. The aim of structuration theory was to overcome this divide, borrowing selectively from both schools to develop a duality from the existing dualism.

The objectivist school refers to functionalism, structuralism and Marxism (Mendelsohn and Gelderblom, 2004: 11). This school focuses on the determining role that social structure or the social environment has on human behaviour. It over-emphasises the constraints of external factors on individual action. Giddens is particularly critical of functionalism, so much that his

work is called a "non-functionalist manifesto" (Giddens, 1979). Within the objectivist school, he primarily makes use of structuralism (such as the work of Lévi-Strauss) to contribute to structuration theory. Structuralism explains behaviour as generated by structures or rules, genetically encoded or socially formed. Giddens (1984) develops the concept of "social structure" that refers to the tacit rules (sense-making and normative), as well as the resources (material and those of social authority) drawn upon in social action.

The subjectivist school focuses on the agency of individual actors, which they believe cannot be generalised or predicted. Giddens extracts a number of general features from the various interpretive approaches, these being hermeneutics, phenomenology, ethnomethodology and symbolic interactionism, towards building a concept of agency (Mendelsohn and Gelderblom, 2004: 30). He takes the idea that social action is a type of rule-following behaviour. People can choose whether and how to apply rules, which means they have a capacity to act in one or more ways. Their capability to act gives them social power. In order to act, they also have to have knowledge of social life. According to Giddens, most of this knowledge is practical or built-in knowledge, which people draw upon without necessarily being able to express it. Finally, their actions are embedded in time. Giddens believe that actions should be seen as an ongoing stream rather that a set of discrete events. Giddens does not provide explicit dimensions of agency, but from his work Mendelsohn and Gelderblom (2004) distil the headings of temporality, capability and knowledgeability by which to further discuss agency.

Giddens brings together objectivist and subjectivist thinking and defines structuration theory as follows. The researcher has italicised phrases referring to recursion, which will become important when structuration theory is likened to autopoiesis at a later stage:

"The basic domain of study of the social sciences, according to the theory of structuration, is neither the experience of the individual actor, nor the existence of any form of societal totality, but social practices ordered across space and time. *Human social activities, like some self-reproducing items in nature, are recursive. That is to say, they are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors*" (Giddens, 1984: 2).

Central to structuration theory is the notion of the duality of structure:

"The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality. According to the notion of the duality of structure, *the*

structural properties of social systems are both medium and outcome of the practices they recursively organize" (Giddens, 1984: 25).

The two faces of the duality, social agency and social structure, will subsequently be considered in more detail.

5.5.1.1 Social agency

Giddens' social actor is situated in the mundane everydayness of social life, where much of the action is habitual. The actor simply "goes on", while routinely monitoring their action and that of others. Giddens distinguishes between three "levels" of monitoring, namely reflexive monitoring of action, rationalisation of action and motivation of action. Reflexive monitoring is expected of competent members of society, making use of their discursive consciousness to account for their actions. It also refers to the tacit monitoring of daily ongoing action. Rationalisation of action refers to the actual performance of activities in a purposive way. A knowledgeable actor figures out an effective way of performing a routine in the process of doing it repeatedly, without necessarily consciously reflecting on it. Motivation of action refers to the unconscious motives or wants that prompt action, and which actors cannot necessarily account for. The most significant one is the avoidance of anxiety. The need for ontological security is also present as a motivation, and is satisfied by means of participation in predictable routines (Mendelsohn and Gelderblom, 2004; Giddens, 1984).

Related to the monitoring of action, Giddens ascribes three levels of consciousness to an actor, namely discursive consciousness, practical consciousness and the unconscious. Discursive consciousness refers to the ability to account for actions when asked to do so. Practical consciousness is the level where most social action takes place. It is the tacit and built-in modes of awareness and competence which people employ during everyday activities. Actors know a great deal about how to interact socially without necessarily being able to express their knowledge. An analogy is given with the way people use language, drawing on the rules of language as they speak without necessarily being able to formulate the same rules. The third level, the unconscious, is below our level of awareness. A healthy unconscious requires social security and trust. This security is found in the routines of our everyday interaction and its predictability. It is also found in the predictability of other people's actions and reactions, and the tact which people employ so that nobody loses face during interaction (Mendelsohn and Gelderblom, 2004: 68 - 72).

Reflexive monitoring of action	(reflecting)	Discursive consciousness
Rationalisation of action	(doing)	Practical consciousness
Motivation of action	(unconscious motivations)	Unconscious

Table 5.1: Giddens' levels of action

Having presented the levels of consciousness, Giddens (1984: xxx) alerts the person intending to do structuration theory based research on the importance of recognising the practical consciousness of the people studied. Methods that draw only on the discursive consciousness, such as surveys and questionnaires, will not do justice to the bulk of people's knowledgeability, which is enacted by their practical consciousness. In interviews, researchers need to be alert to non-verbal communication. In the light of Giddens' remarks, this researcher regards the use of participant observation as an important information collecting method.

5.5.1.2 The notion of temporality in agency

Giddens' conception of agency is situated in time. Drawing on Heidegger, Giddens argues that agents' existence is essentially temporal. In the present moment, the memory of the past is with us, as well as anticipation of the future. Time is continuous, and along with it social action is a "continuous flow of conduct" (Giddens, 1979: 55). Social action is repetitive within time cycles, whether days, weeks, seasons or generations. The bulk of our actions are part of the "durée" of everyday life, which is reversible because routines can be changed. These daily routines contribute to the life span of the individual, which is biologically irreversible, as well as to the reversible "longue durée" of institutional time (Giddens, 1984: 35; Mendelsohn and Gelderblom, 2004: 60). Structurational research needs to take into account the temporal existence of social actors, and look for the routines in which actions are embedded.

In terms of the duality of structure, the daily social routines of actors contribute to long-term institutional practices, which are also the medium of the daily routines, that is, the daily actions are performed under the security and stability of the underlying "longue durée" (Giddens, 1984: 36; Mendelsohn and Gelderblom, 2004: 65).

5.5.1.3 The notion of capability in agency

With the notion of capability, Giddens does not refer to intentions or the ability to make decisions (Mendelsohn and Gelderblom, 2004: 61). According to Giddens, many of the routinised social actions do not require cognitive effort or conscious choices. Actors simply continue to do things in their routine, and sometimes they do them differently. Capability is about the potential to do something if one could have done otherwise. Action is purposive rather than purposeful. People do not have explicit goals in mind to direct their actions. Sometimes they think about their action (reflective monitoring of conduct) but most often, our stream of conduct is pre-reflexive with little mental application.

Power is an important concept related to action. It refers to the transformative capacity of action. Our ability to act or intervene can result in a change of affairs. A person has power when they have the ability to make a difference in a situation; otherwise, they are powerless. Power is more than a force, it is the medium of agency or change, as time is the medium in which action occurs.

Giddens mentions two kinds of power: strategic and relational. Strategic power refers to the general ability to intervene, get things done and effect change. Relational power refers to the ability to influence the agency of other people in order to achieve an outcome (Mendelsohn and Gelderblom, 2004: 62).

Capability relates to the duality of structure as follows. Resources (allocative or material resources, and authoritative resources or social power) are the structural elements that are drawn upon to exercise power. The action or transformative capacity to exercise power in turn produces these resources.

5.5.1.4 The notion of knowledgeability in agency

Knowledgeability refers to what social actors know about society and how to act in it. Giddens is highly critical of the way that functionalism and Marxism downplay agents' knowledgeability (Mendelsohn and Gelderblom, 2004: 64). He believes that we are not puppets acting an institutional script, but we know, interpret and reflect. Giddens' "knowledgeability" is conceptualised making use of Schutz's stocks of knowledge (interpretive schemes plus commonsense beliefs) and Garfinkel's indexicality. Indexicality refers to a commonly understood shorthand for communication: people understand the abbreviations used by others and also know the meaning of what is left unsaid. In people's

ongoing action, they have devised social recipes which guide their actions. These stocks of knowledge are commonly held in society, and present the background knowledge or context within which to understand other people's actions.

Knowledgeability plays out in the duality of structure as follows. Knowledgeable agents implicitly know and apply rules of structure during social action, and in turn generate those rules of structure. Social rules are the abstract property of knowledgeable agents. These rules are absent (exept as memory traces) but made present through the knowledgeability of actors (Mendelsohn and Gelderblom, 2004: 65).

5.5.1.5 Social structure

Social structure refers to the "patterning of social relations" (Giddens, 1984: 16). Structure is both absent and present. It is absent in that it does not exist in time and space. It exists as memory traces in the minds of actors, and is made present as it is instantiated in the social actions of actors, which have structural properties. Structure makes the binding of time and space possible as it allows for similar social rules or practices to be repeated across time and space, and thus become systemised and eventually institutionalised. This repetition of social practices over time and space are referred to as routinisation and regionalisation (Mendelsohn and Gelderblom, 2004: 83). Action repeated over time and space contributes at an individual level to people's ontological security, and at societal level to ensure the reproduction of society. As discussed in the section on temporality above, routinisation binds the "duree" of daily activity with the "longue duree" of institutional time. Repetition in different locales leads to regionalisation. A locale has a social meaning or context. For example, a sports pavilion is associated with certain kinds of social activity and a restaurant with others. People expect a certain kind of behaviour from others in a restaurant and also enact it repeatedly.

According to Giddens (1984: 17), structure consists of rules and resources. Rules and resources do not exist independently: they only exist as part of the structuration process, where the use of rules can be inferred from the knowledgeability of agents and the use of resources from their capability, as observed when they act. Rules and resources are interrelated, and are only separated for purposes of analysis. The application of authoritative resources implies social rules, and the application of rules implies the exercising of power and thus an unequal access to resources (Mendelsohn and Gelderblom, 2004: 87).

5.5.1.6 Structural rules

Rules cannot be observed directly; one can only see the outcome of their application. They can also not necessarily be described or formulated. They are often tacit and part of our practical consciousness. They are part of the context where they are applied and thus adaptable (Mendelsohn and Gelderblom, 2004: 89).

"Rules have two aspects to them… [namely] the constitution of meaning, and …the sanctioning of modes of social conduct" (Giddens, 1984: 18). These two aspects are separated for analytical purposes, into interpretive rules that help to define or understand something, and normative rules that help to sanction or approve social behaviour. The rules of social life are compared to the rules of games, such as chess. Giddens state that the rules of chess are neatly defined and well bounded. They also work together neatly as a coherent whole. In social life, the definition and application of rules are far more messy. They are more like the rules of children's games, which are constantly improvised and in flux, and changed to fit the situation and the whims of the players. Giddens also compare social rules to a mathematical series, in the sense that the next action can be inferred from the existing history of instances, so that in knowing its history, one also knows how to continue its application, without necessarily being able to express it.

5.5.1.7 Structural resources

Resources have to do with people's capacity to perform tasks. Different people have different resources to their disposal, enabling some people to be more powerful or to dominate a situation socially. Power in itself is not a resource, but people who are able to mobilise resources are powerful. Two types of resources are distinguished: allocative and authoritative. Allocative resources refer to material things which help to command the natural world. These can be raw material, technology or goods produced as a result of the combination of these (eg material wealth). Authoritative resources refer to the capability to command people; to coordinate or control social interaction. It is the ability of people to promote themselves or their ends given their social skills. As with other concepts in structuration theory, these are interdependent, as allocative resources can be used to effect social power and vice versa (Mendelsohn and Gelderblom, 2004: 89).

5.5.1.8 The dimensions of the duality of structure

For purposes of analysis only, action and structure can be separately studied, and three dimensions can be separated. In practice, all three are interrelated and occur together, as is the case with agency and structure (Giddens, 1984: 29; Mendelsohn and Gelderblom, 2004: 93). The diagram below is an integration of the way it is presented in Giddens (1984: 29) and in Mendelsohn and Gelderblom (2004: 93). The modalities of structuration, inserted between agency and structure in Figure 5.2 below, mediate between agency and structure. They enable actions and assist to reproduce structure. For example, the activity of speaking or communication is associated with the structural aspect of interpretive rules (of signification). These two aspects are mediated by interpretive schemes or stocks of knowledge.

INTERACTION	communication	power	sanction
MODALITY	interpretive schemes	facility	norm
STRUCTURE	interpretive rules (of signification)	resources (domination)	normative rules (of legitimation)

Figure 5.2: Dimensions of the duality of structure

Social institutions are characterised according to which of these modalities feature stronger or are more salient in their instantiation of social practices. For a symbolic institution, such as a professional society, the modality of signification is most salient. For a political institution, authoritative domination is more salient. For an economic institution, it is allocative domination, and for a legal institution, the modality of legitimation (Giddens, 1984: 33; Mendelsohn and Gelderblom, 2004: 97).

5.5.2 Social systems

Structure is virtual, but the social systems and institutions resulting from it (and giving rise to it) are present in time and space (Mendelsohn and Gelderblom, 2004: 83).

The following “levels” of socially embedded structure exist:

- Social practices: social activities which are regularly repeated by actors;

- Social systems: social practices repeated over time and space, by many actors;
- Institutions: social practices deeply embedded in time and space; and
- Society (Giddens 1984: 164): a strong cluster of institutions, often going along with a particular locale or type of locale, over which the society believes it has a claim. There is also a shared social identity, whether it is explicitly labelled as such or not. Our idea of society should not be limited to present-day nation states, the latter which happen to be well defined and well bounded.

Whereas in functionalist systems theory, a system's structure is a physical presence that can be studied independent of functioning, a societal structure only exists insofar as the society is functioning. A social system is the result of repeated social practices by many actors: social systems "consist … in the persistence or repetition of social relations" (Mendelsohn and Gelderblom, 2004: 86). Similarly, Delaney et al. (2008: 9) interpret Giddensian social systems to be "reproduced relations between actors or groups, organized as *regular social practices* that occur in time and space." Social systems have structural properties that can be inferred from observing the acting out of social practices.

The *boundaries* of a social system are more open than that of a society, and can span two or more societies. The boundaries are fluid over both time and space, unlike that of a physical or biological system. People may belong to a number of different social systems at the same time (Giddens, 1984: 164). The *scope* of a system refers to the amount of time and space that it binds or takes up.

Giddens distinguishes between social integration and system integration. He views social integration as the level of integration *within* a social system. This integration is higher if there are more face-to-face interactions, regularised ties and reciprocity of practices within the system. System integration refers to the level of interaction *between* groups or social systems. He believes that individual social action is the foundation for system integration and disagrees with functionalists that want to understand integration from analysing collective behaviour (Mendelsohn and Gelderblom, 2004: 87).

On feedback in a social system, vs. reflexive monitoring of action: Giddens (1979: 75) accepts Buckley's argument that the systems notion of feedback is a higher order notion that distinguishes social systems from mechanical systems. However, according to Giddens, the reflexive monitoring of action among human actors is a notion superior to that of system

feedback. In other words, Giddens holds that the human notion of reflexive monitoring cannot be reduced to a system feedback process.

5.5.3 Assessment of Giddens' social system

Bailey's (1994: 13) take on Giddens' systems views is that there is an amazing correlation between Giddens' statements and the "new systems theory" advocated by Bailey. According to Bailey, both he and Giddens have independently applied the learning and insights that followed earlier social systems views (in particular functionalism), and come to similar conclusions, even if worded differently. The implication of Bailey's reflection is that Giddens' social systems views are in line with the latest insights on social systems at the time. Bailey claims that if Giddens put his mind to it, he could have developed a coherent social systems theory, fragments of which are visible or implied in Giddens' writing.

A personal reflection is that whereas Giddens provides a fresh new way of viewing social systems, not all of his systems notions are credible. For example, his conception of homeostasis in Giddens (1979: 78) appears to be problematic. He tries to improve on the functionalist definition of feedback, but then only incorporates one kind of causal loop, namely a self-reinforcing one. The poverty cycle is given by Giddens as an example of a homeostatic social cycle. However, we know from systems theory (Chapter 4) that homeostasis involves corrective or "negative" feedback. Personally seen, the relationship between educator and pupil would provide a better example of social homeostasis, involving a combination of affirmative and disciplinary feedback loops.

Despite the above example, Giddens' overall conceptualisation of social systems, based on structuration theory, provides a conceptually sound construct that can be well used when describing social systems.

5.6 Assessment: systems thinking in social theory

5.6.1 Reflection on systems thinking found in social theory

The use of systems concepts in social theory is fragmented, and at times selective and superficial, as shown out by e.g. Buckley (1967) and exemplified by Graaff (1994). Remnants of mechanical thinking are still entrenched, as can be seen in everyday vocabulary when people talk about "mechanisms for change" or "guiding forces". Whether such thinking is

seated deeply in our world views, or is superficial and limited to phrases of which the origins are not queried, as argued by Buckley, is not clear. Biologically-based concepts appear to have been used widely in social theory, with functionalism its major and most well known proponent. Unfortunately, extreme functionalism with its connotations of teleology, its strong normative slant, and its obsession with social order at the cost of recognising inherent and necessary drivers of change, has been made a straw dog and ridiculed. It has given organism-based social system views a bad name, which a small group of neofunctionalists are attempting to recover. For example, Luhmann's work shows a careful application of functional principles together with other theory, such as autopoiesis, to contribute to the understanding of subsystems in society. Giddens' structuration theory, developed partially in response against functionalism, has managed to synthesise opposing social theories. He provides a fresh approach and definition to a social system. Bailey argues that Giddens' skeletal social systems ideas are in line with the latest insights on social systems at the time, and could have been developed into a substantial social systems theory.

In general, it can be seen that people have used new developments in scientific as well as systems thinking to make sense of society, as with the mechanical and astronomy-based social systems views of the 17th century, in Pareto's and Parsons' work, and in the influence of general systems theory and cybernetics, for example in Buckley's work.

An interesting point on social systems is suggested by Buckley (1967): that a social system differs in nature from a mechanical or biological system in its ability to change and renew itself, possibly developing to new societal states that cannot necessarily be imagined from a study of the status quo. The insight that biological species that are not adapted die out, whereas social systems do not die but change, is also significant.

Bailey's (1994) overview is regarded to carry weight, since it is relatively recent and presents the work of a sociologist who has expended effort in finding the most promising post-functionalist systems theories and studying their fundamentals, to assess their social applicability. Two of the three systems theories he highlighted, were his own (SET) and one related to his own (living systems theory). The third was autopoiesis. Whereas he could be expected to be subjective about the first two, the same cannot be said for his inclusion of autopoiesis. Bailey recognised the merit of further exploring autopoiesis' social conceptualisations, such as by Mingers. Bailey's position on autopoiesis (of which he shows the merits as a systems concept, before studying its social application) has to be read together

with Bailey's position on Giddens' social systems, to see the value implied in a structuration-based social autopoiesis.

5.6.2 Applicability of social systems theories for use in this study

Of the social systems theories reviewed, which are feasible candidates for describing the social context of ICT4D, and which would also be able to assist in assessing an ICT4D project's impact on the social system(s) served?

The researcher's assessment is that earlier systems views, such as mechanical and functionalist views, cannot be seriously considered. Despite the work of Merton and the neo-functionalists to address problems within functionalism, most of the critique discussed above is still valid, such as its teleological view and its over-emphasising of orderliness and regulation.

Buckley's view of society as a complex adaptive system that uses internal feedback processes to adapt its structure appears promising, at least in theory. Luhmann's work, proposing that social systems self-produce by means of communication, also appears to be a possible candidate. However, Luhmann's work on social subsystems of modern-day society that include political, economic, scientific and education subsystems (more detail in Chapter 6) would not necessarily be appropriate for a rural African society. The subsystems of significance in rural Africa may be very different ones, requiring revisiting Luhmann's theory. Giddens' conception of a social system based on structuration theory appears to provide exciting theoretical constructs when used as a social systems approach. The three systems theories suggested by Bailey for social application, namely social entropy theory, LST and social autopoiesis, also appear to be potentially suited candidates.

A challenge presented by all of the above candidate theories, is that since they originate from social theory, they are more suited for conceptual application than empirical application. Most of them do not have a history of having been applied to a detailed, specific social context. A possible exception is Giddens, whose work has been used before in an IS and ICT4D context (see Chapter 7). However, where Giddens' structuration theory has been empirically applied before in ICT4D, it was without making use of his social systems concepts.

Having provided an overview of systems thinking in social theory in Part I of this chapter, Part II moves to the selection of a social systems theory.

Part II: Selecting a social systems theory

5.7 The challenge of selecting a social systems theory

In this section, the challenge will be addressed of selecting a social systems theory or approach from the candidates presented in this chapter as well as in Chapter 4. Overall, a diverse array of systems approaches or theories have been introduced and discussed. In Chapter 4, it could be seen that general systems concepts have been applied directly to social systems, but also modified in various ways to accommodate character traits of social systems such as pluralism, coercion and complexity. In this chapter, it was shown how social theorists incorporated the systems thinking of their time into social theories, leading to a range of thinking about social systems in sociology: from functionalism through to Luhmann's and Giddens' very different respective approaches.

After having performed basic feasibility assessments of the systems approaches and theories presented, there are many possible candidates that remain. How does one go about selecting among these candidates, that is, how does one decide which social systems theory or approach is most suited to apply in a particular social setting? Are there any best, or at least superior social systems approaches? Personal consideration of this question has led to the conclusion that even after the assessments provided, such prioritisation will be subjective, with a likelihood of not doing justice to all candidates. (As it is, the candidate theories or approaches introduced in Chapters 4 and 5 do not form an exhaustive list). Rather, what is proposed is a general set of criteria for selecting a social systems approach. The suggested criteria are given below. For a particular approach to be feasible, the responses to the criteria need to be *mutually compatible*. The set of criteria below bears similarities with the "questions of context" suggested by Mingers (2006: 219) as a departure point for a multimethodology process. Mingers' questions can be used to enrich the questions stated below, in relation to the stated criteria.

5.7.1 Objective of the systems exercise

Gregor (2006: 611) identifies four goals of using a theory, namely "analysis, explanation, prediction, and prescription". Similarly, a systems exercise can be done for reasons ranging from description, for the sake of better understanding of the situation, to its being the basis of a practical intervention. Mingers (2006) suggests that an OR exercise will aim towards appreciation, analysis, assessment and/or action, these being the different phases of an OR

intervention. Daellenbach and McNickle (2005: 23) state that we "view something as a system for a given purpose". Some systems approaches will suit the particular purpose better, for instance SSM is an interventionist approach meant to involve all role-players, whereas most of the social theories incorporating systems thinking will be better suited to description, analysis and perhaps explanation.

5.7.2 Nature of the social system

Checkland (1999) argues that the nature of a human activity system is different from a natural or designed system, which means that it requires a different approach when engaging with it. Further, he argues that social systems have elements of both human activity systems and natural systems, and so both have to be recognised in a social systems approach (1999: 121). Rosenhead and Mingers (2001) distinguish between well-defined and messy systems, the latter always having a social component, and requiring an approach that can deal with the messiness. A messy system may be unstructured, ill-managed, politicised and/or undergoing radical changes. Further, one can ask if a system has an identifiable structure, such as a traditional western business organisation. How easily can boundaries be drawn? What are the defining features of the system, and what rate of change needs to be taken into account?

5.7.3 Characteristics of the social systems approach

As with a theory, a systems approach focuses on particular aspects of a situation, or particular variables and the interaction among these. Will the approach be able to assist the analyst or researcher in achieving the goals of the exercise? If they are research goals, will they assist in addressing the research problem and questions? Is the approach appropriate to the nature of the system investigated? Being a social systems approach, does it recognise the characteristics of a human activity system, as well as its natural systemic nature (Checkland, 1999: 121)?

Truex et al. (2006) propose four aspects to be considered when adapting a theory from another domain into IS research: the fit between the theory and phenomenon of interest, the theory's historical context, the fit between the theory and research method, and the contribution of the theorising process to cumulative theory, meaning that the new theory should be compared to existing theories when arguing for its value addition. These aspects can similarly be considered when introducing a social systems theory into ICT4D.

5.7.4 Preferences of the analyst(s)

The prior knowledge, background, personality and personal preferences of the analyst will play a role in the successful application of a particular approach. Mingers (2006: 219) suggests some questions to assess the compatibility between the analyst and potential approach. Walsham (2006: 324) contends that in interpretive research, "the choice of theory is essentially subjective", and that apart from rational motives of choosing a theory, it needs to "speak" to the researcher. He suggests that researchers choose a theory firstly because they feel personally comfortable with it and it appears insightful to them. However, there should be a basis to motivate for its use. If the potential value of using a theory needs to be confirmed, he advises a preliminary analysis presented as a working paper or at a conference, with the author requesting feedback. From this, the researcher deduces that subjectivity in preference is acknowledged, although it needs to be an informed subjectivity.

5.7.5 Presenting and motivating for a candidate

Rather than rating all the identified candidate systems theories or approaches against the criteria presented, the researcher will present her own preferred candidate for scrutiny against the criteria. As such, the criteria will be used to motivate the researcher's subjective preference. The researcher's own preference was informed by bounded rationality (Simon, 1979) which is characterised by a process of sequential searching and satisficing. Satisficing entails looking for a solution that is good enough, but not necessarily optimal.

The researcher's personal choice is one suggested by Bailey (1994) in his discussion of relatively recent systems theories that have the potential to make a contribution to social science, namely social autopoiesis theory. Bailey's describes autopoiesis as "one of the most exciting new notions in systems theory in particular, and in social and behavioural science in general" (Bailey, 1994: 285), and shows his satisfaction with its epistemology as well as its hermeneutic, interpretive and non-functionalist approach. Following Bailey's publication in 1994, more work has been done to theoretically conceptualise social autopoiesis, notably by Mingers (1995; 2002; 2004; 2006). Mingers suggests a conceptualisation of social autopoiesis that makes use of Giddens' structuration theory to define a social system. The notion of social autopoiesis will be developed into a systems framework for data collection and analysis on an ICT4D case study (Chapter 7), prior to which the concept of social autopoiesis is assessed in more detail to confirm its theoretical suitability (Chapter 6). Before proceeding with such an exercise, the suggested theory is motivated by means of the criteria presented above.

5.7.5.1 Objective of the systems exercise

The goal of the exercise is to describe and analyse the social context in which an ICT4D project is undertaken, in order to assess the influence or impact of the ICT4D project on the encompassing social system. The impact of interest is that of socio-economic development, in particular Roode et al.'s (2004) notion of self-reliant human-scale development that includes interdependence with specific neighbouring systems. The notion of self-reliance is related to autonomy and sustainability. The impact of the ICT4D intervention on the autonomy and sustainability of the social system is hence of interest.

Social autopoiesis theory makes use of concepts from structuration theory as well as autopoiesis. Structuration theory is a descriptive social theory that is widely recognised and used in IS and ICT4D, to describe the underlying social structures in a community, and the manner in which these social structures are recursively recreated by human actors. The theory of autopoiesis is concerned with identifying, describing and analysing the self-producing mechanisms of a system, and among other, the processes of structural coupling or interdependence with surrounding systems.

A systems description making use of the above constructs can be performed for an ICT4D project's encompassing social system, as the system served, after which it can be investigated how the ICT4D project, as the serving system, influences these aspects. If social autopoiesis theory is used in this manner, structuration theory can be used to provide a rich description of the social system(s) served by ICT4D, focusing on the system's self-producing structures, and whether these contribute to the system's autonomy. The autopoiesis concept of structural coupling can be used to investigate the interdependence of the social system with neighbouring systems. According to autopoiesis theory, aspects such as the ability to self-produce and to have mutually beneficial structural coupling with its environment, contribute towards the autonomy and hence towards the sustainability of a system.

Autopoiesis theory also includes other theoretical concepts, for example concerning the system's boundary, organisational closure and structural drift. The social application of some of these concepts is contentious and need further investigating. This will be done in Chapter 6. For now, the discussion above has made it clear that social autopoiesis theory, with its specific focus on describing self-producing mechanisms and assessing sustainability and interdependence with other systems, has the potential to meet the above stated goals of the exercise.

5.7.5.2 Nature of the social system

According to the above criteria, the selected social systems approach needs to recognise the characteristics of a human activity system as well as a natural system, as per Checkland (1999). The social definition of the system, making use of Giddens' structuration theory, means that the system is recognised as a human activity system. The notion of autopoiesis has biological or natural system origins, and in a sense still treats the system studied as a natural system, even if it is a social system. As such, social autopoiesis theory recognises the system studied as a human activity system as well as a natural system.

The criteria above also suggest that the nature of the particular social system studied needs to be understood and recognised by the systems approach. In this study, the overall community served is relatively remote, geographically and to a large extent socially isolated. The two systems served within this community, the Zulu and mission social systems, both appear to have strong self-producing social identities. As such, social autopoiesis theory with its emphasis on self-production and influence of social boundaries appears to be suited to the study of these social systems.

5.7.5.3 Characteristics of the social systems approach

In the previous paragraph, it has been argued that the characteristics of the preferred social systems theory are suited to the nature of the social systems to be studied. Further, social autopoiesis theory's means to investigate the self-reliance, sustainability and interdependence of the systems of interest, makes it an attractive means to study the notions of sustainability and socio-economic development in an ICT4D context.

The criteria proposed by Truex et al. (2006) when applying a theory from outside of the IS domain, summarised in section 5.7.3, are addressed as follows:

- The fit between the social systems theory and the application domain (a social system in ICT4D) is argued in section 5.7.5.2 above;
- The historical contexts of the theory's building blocks, including the debates and controversies around them, are considered in Chapters 4 to 6;
- The fit between the theory and the research methodology is discussed in section 3.2.6; and

- The contribution of the theorising process to cumulative theory is addressed in Chapter 2, when arguing for a systems approach in ICT4D to address concerns such as sustainability and development at the level of the encompassing social system, since these concerns are not sufficiently addressed in current ICT4D research.

5.7.5.4 Preferences of the analyst(s)

The researcher, as analyst, has a personal interest in applying systems thinking to social systems in novel and different ways. Her background in Operations Research and working with systems engineers while trying to address large-scale social problems, has prepared her for doing such an exercise. Her interest in social theory, systems theory and interdisciplinary work means that a social autopoiesis theory is aligned with the background knowledge and personal interest of the researcher. In Walsham's (2006) words, the theory "speaks" to her.

Her subjectivity is an informed one, based on a wide literature review on systems thinking applied in the social domain. Social autopoiesis' combination of autopoietic principles and Giddens' structuration theory was found intuitively attractive to the researcher, while she could also motivate that it integrated sophisticated recent systems thinking with some of the best social theory available, to promise a good social systems theory. Since a theory such as this is not typically used in an ICT4D context, and it is not a mainstream theory even in the systems field, there was a need to test out the idea with experienced researchers. This has been done by means of writing a paper and eliciting feedback informally from colleagues and experts, and formally by presenting it at two conferences.

5.7.6 The way forward with a social systems theory

Having motivated for a social systems theory that holds promise for application in the ICT4D context, the theory will hence be studied further and its theoretical applicability will be confirmed in Chapter 6, before proceeding with its practical application.

5.8 Conclusion

In this chapter, the second half of the journey to search for social systems approaches to apply in an ICT4D context was documented while addressing the research question:

- How does the literature approach social systems, from systems thinking and from social theory perspectives?

A chronological overview of systems thinking in social theory started by showing the use of mechanical metaphors during the enlightenment, and biological analogies used since the nineteenth century. Functionalism, the most well known biologically based social theory, was also deeply influenced by the Christian religion. Functionalism is value-based and strives towards balance, order and moral consensus. While functionalism was very prominent in the mid twentieth century, it elicited strong criticism, which served to inspire new theories. Among these are Buckley's work, which emphasises the variability and adaptability of social systems, and Giddens' structuration theory, which attempts to synthesise functionalist and interpretive thinking. Other systems-based social theories of the twentieth century include Living Systems Theory and Social Entropy Theory. The biological concept of autopoiesis informed Luhmann's social theory, as well as a social autopoiesis suggestion by Mingers, incorporating autopoiesis and structuration theory.

The literature overview of systems thinking in social theory concluded with a reflection on the applicability of the theories to describe the social context in an ICT4D study. After having scrutinised the systems literature (in Chapter 4) as well as social theory literature for potentially suitable approaches to apply in an ICT4D context, the following question became relevant, and was considered in Part II of this chapter:

- What is an appropriate social systems framework with which to study the impact of an IT intervention on a remote, rural African community?

The sequential descriptions and reviews of social systems theories from the systems as well as social theory literature led to the identification of some feasible candidates. The researcher realised that to select a social systems theory from the feasible candidates was not straightforward. The suitability of an approach depended on a number of factors related to the particular application context. The criteria the researcher came up with bear similarity to Mingers' (2006) criteria for selecting methods as part of a multimethodology approach, as discussed in Chapter 4. The criteria relate to the mutual compatibility of the following:

- The objective of the systems exercise;
- The nature of the social system;
- The characteristics of the approach or theory; and
- The preferences of the analyst.

The decision-making process to select a theory involved a bounded rationality searching and satisficing exercise rather than a rational decision analysis exercise. As such, the researcher chose to assess the 'satisficing' ability of her preferred theory, namely social autopoiesis that includes structuration theory, against the suggested criteria. The assessment against the criteria serves to motivate for the theoretical applicability of the approach. The practical applicability is assessed empirically by means of a case study, which is presented in Chapters 8 and 9.

Before commencing with the practical application of the theory, some further preparation work is required. First, autopoiesis theory is introduced in more detail and its use in the social domain is investigated, to confirm autopoiesis' social applicability. This is done in Chapter 6. In Chapter 7, the theoretical concepts of social autopoiesis theory are developed into a systems framework for practical application, thereby further addressing the research question:

- What is an appropriate social systems framework with which to study the impact of an IT intervention on a remote, rural African community?

Chapter 6 Autopoiesis and its social application

6.1 Introduction

In the study of social systems theories in Chapter 5, social autopoiesis has been identified as a promising concept to include in a social systems framework for an ICT4D study. Before proceeding to apply it, the basic principles of autopoiesis need to be first understood, and its general social applicability needs to be confirmed. This chapter presents an overview of the theory and applications of autopoiesis, with a particular emphasis on its social application. In doing so, it addresses the following research question:

- What is the value of the theory of autopoiesis when applied socially?

The chapter commences by introducing the basic principles of autopoiesis, making use of Maturana and Varela's own writings, e.g. Varela et al. (1974), Maturana (1981), Varela (1981) and Maturana and Varela (1987), as well as Luisi (2003), a co-worker of Varela. Mingers' (1995; 2006) work on autopoiesis is also used, since his interpretation of Maturana and Varela's work appears to be careful and thorough. In introducing the basic concepts, a broad overview is provided, while a few concepts such as those related to biological reproduction are omitted, since they do not have direct bearing on the social framework that follows.

The chapter continues with a discussion of the social applicability and social application of autopoiesis. Although the corresponding literature is diverse and fragmented, an attempt is made to concisely present the major streams of thinking and schools of application in the social domain. The application section concludes with an argument for the social applicability of basic autopoiesis concepts, without necessarily having to prove that social systems are autopoietic in an ontological sense.

Presenting information on autopoiesis is not a straightforward task, since the theoretical principles are conceptually challenging, and as indicated in the quote below, the primary literature is not always accessible: "Despite the excitement generated by this approach, there are some hindrances which have kept it from spreading more rapidly. Perhaps chief among these is the complex writing style of Maturana and Varela" (Bailey, 1994: 287). The researcher has attempted to present the concepts accurately as well as in an accessible format.

6.2 Basic principles of autopoiesis

The theory of autopoiesis is developed by the Chilean biologists Humberto Maturana and Francisco Varela as a way to distinguish between living and non-living systems. Living systems are usually characterised by a set of features, such as movement, feeding and reproduction. However, Maturana and Varela are interested in the "mechanism" of life, or the arrangement that makes life possible.

"*Instead of asking what makes a living system reproduce, we ask what is the organisation reproduced when a living system gives origin to another living unity?*" (Varela et al., 1974: 187).

According to them, the distinguishing mechanism is that living beings are self-producing: they produce their own building blocks and keep reproducing the associated processes (Maturana and Varela, 1987: 43). As part of the process of self-production, a boundary is formed. The boundary not only limits the self-production network but also dynamically participates in the self-production process (Varela et al., 1974: 191; Maturana and Varela, 1987: 46). The key example provided by Maturana and Varela is that of a single living cell that produces its inner components as well as a cell membrane. Chemicals move through the membrane, such as nutrients and waste. However, the cell is autonomous and determines what it allows to move through the membrane. The self-producing process described above is termed ***autopoiesis***, which literally means self (auto) – production (poiesis).

Systems that produce not themselves but something different are called allopoietic. As opposed to autopoietic systems, they are not autonomous (Varela et al., 1974: 189). Examples of allopoietic systems are a ribosome (biological system) and a factory (mechanical system).

In the sections that follow, terminology will be introduced in bold face as necessary when presenting the theory.

6.2.1 Unity, organisation and structure

A ***unity*** is an entity distinguished by an observer, viewed within an environment but distinct from it. A composite unity is one in which we choose to distinguish the components (Maturana, 1981: 24). A unity always has an observer. The reasons for selecting a particular

unity and the manner in which it is observed are determined by the observer (Mingers, 2006: 37).

Organisation refers to "the relations between components that define a composite unity (system) as a composite unity of a particular class." All that matters of the properties of the components is what they contribute to realise the organisation of the unity (Maturana, 1981: 24).

"A complex system is defined as a unity by the relations between its components which realize the system as a whole, and its properties as a unity are determined by the way this unity is defined, and not by particular properties of its components. It is these relations which define a complex system as a unity and constitute its ***organisation***" (Varela et al., 1974: 188).

The notion of organisation implies an arrangement of components, each of which has properties that contribute to define the unity overall. The analogy in a designed system could be seen as its functional design. (It is acknowledged that Maturana and Varela's view is not functionalist, and that 'functionality' is a meaning attached by an observer.) Similar to a functional design, the notion of organisation is an abstract one.

A composite unity's ***structure*** refers to its physical embodiment in space and time. The structure refers to the unity's components and processes that are arranged in a particular manner so as to realise its organisation.

There may be many ways to realise a unity's organisation in a particular structure. For example, the concept of a car implies a certain organisation, including a powering mechanism, wheels, steering, brakes, seating and protection for passengers. These attributes and the relations between them are part of the *organisation* of a car. A Volkswagen Jetta 5 is an example of the embodiment of this organisation, and its particular seats, engine, steering column and brake technology represent its *structure*. Structure includes the particular elements of process of the Jetta 5, and not just the hardware. Further, there are properties of the components, such as their colour, that are immaterial to the organisation of the car.

According to Maturana and Varela (1987: 43), living beings are characterised by an organisation that is autopoietic or self-producing. It follows that living beings are ***autonomous***, meaning that they specify their own laws, or operation (1987: 48). They are not the only kinds of system that are autonomous, but what characterises living beings is that they

are autonomous because of autopoiesis. Another way to describe autonomy is to say that the relations that characterise an autonomous system "involve only the system itself, and not other systems" (Maturana, 1981: 22). This latter point will be revisited when the theory is applied in later chapters.

6.2.2 Organisational closure and the role of the boundary

An autopoietic system is open from a structural point of view, as can be seen with a living cell that allows certain chemicals through its membrane. However, it is operationally closed, meaning that it is autonomous and innately "produces its own rules of existence" (Luisi, 2003: 51). Mingers refers to ***organisational closure***. The system's organisation implies a certain range of activities, or structural states. One state always leads to another state within the range (Mingers, 2006: 42). Varela (1981: 37) defines organisational closure as the "indefinite recursion of component relations". Another way to look at it, according to Mingers, is that an organisationally closed system is not characterised by its transforming of inputs into outputs, but rather by the circular notion that it transforms itself into itself.

It has been noted that the boundary is an active participant in the self-production process. Luisi notes that a system's capability to make its own boundary is often the most significant indicator of whether a system is autopoietic or not (Luisi, 2003: 51). The boundary is not the only reason for the system's operational closure (the closure is not a physical one; indeed, the autopoietic system actively engages with its environment). The boundary also delineates the physical space in which the autopoietic production processes occur.

6.2.3 Multicellulars: introducing structural coupling

The ***ontogeny*** of a unity is the ongoing structural change that occurs in the unity during its lifetime, while its organisation remains the same. Structural change can be brought on by the unity itself or it might be triggered by its environment which could include other unities (Maturana and Varela, 1987:74).

Structural coupling refers to the recurrent interactions between two or more unities, or between a unity and its environment, such that a perturbation initiated by one triggers a structural change in the other, and vice versa (Maturana and Varela, 1987: 75). Through a series of non-destructive mutual triggers, they manage to co-exist in a compatible way.

In the view of evolution presented by Maturana and Varela, multicellular organisms originated as a result of the close structural coupling between unicellulars, the latter which were the first living entities. In multicellulars, there is a history of component cells that coupled so closely that they have come to depend on each other for their own autopoiesis (Maturana and Varela, 1987: 77).

A single living cell is autopoietic, and multicellular organisms are made up of multiple such cells. Are multicellulars then also autopoietic? Maturana and Varela refer to single cells as ***first-order autopoietic systems***, and multicellulars as being ***second-order autopoietic***. They claim that multicellulars are operationally closed. Further, multicellulars reproduce and form lineages by means of individual cells. In the process, the autopoiesis of the component cells are preserved, and the organisation of the multicellular unities are conserved. Maturana and Varela note that their statements on autopoiesis apply to first-order as well as second-order autopoietic systems, but leave open the question whether multicellulars are first-order autopoietic (Maturana and Varela, 1987: 88).

6.2.4 Structural determinism

A trigger from outside (or within) a unity can result in a structural change in the unity. At any given moment, the unity has a set of possible structural states it can change to, while maintaining its organisation. It can also change into being destroyed. A trigger that leads to a change where organisation is conserved is called a perturbation, otherwise it is referred to as a destructive interaction. Maturana and Varela stress that the *change in structure is always determined by the unity and not the environment*. This is called ***structural determinism***. In simpler systems of which the structure and its environment are understood, it may be possible to predict the response of a system to a trigger. However, predictability is not always possible and structural determinism does not imply predictability (Maturana and Varela, 1987: 123).

6.2.5 Structural change: ontogeny, phylogeny and structural drift

Maturana and Varela claim that the concepts of structural determinism and structural coupling hold for all systems, not just living systems. What is different with living systems is that their organisation (or autopoiesis) is maintained in the process. The ontogeny, or ongoing structural change that happens while the living system's organisation is maintained, is also called ***structural drift*** (Maturana and Varela, 1987: 103).

Maturana and Varela continue to describe the process of evolution as a natural structural drift. They introduce the term ***phylogeny***, which refers to a succession of life forms over time, generated through reproduction. (Reproduction is necessary for a life form to continue its process of evolution, but a particular unity can be alive without reproducing, such as a mule. Hence, reproduction is not part of the definition of autopoiesis (Varela et al., 1974: 189)). Species that have enough structural variety to successfully respond to changes in their environment, survive such changes, and others do not. Those that survive, continue with the process of structural coupling, their ontogeny at any time being a result of the state of the environment as well as their own structural state, which, with triggers from the immediate environment determines their next structural state. Organisms vary slightly from one generation to the next, while abrupt changes in the environment forces them to change their structure more drastically to adapt. The environment itself has its own dynamics, and is influenced by all the systems interacting with it. The sum of all these structural changes over time, for all life forms, provides us with the collection of living beings and their environment as it is today.

Evolution is described here as a natural drift, rather than a natural "selection" (the latter would imply that the environment does the selection, which with structural determinism is not the case). It is simply the product of ontogeny with successful structural coupling, implying successful adaptation, and that organisation is conserved (Maturana and Varela, 1987: 103-117). There is no higher goal or aim that directs the process of evolution. It occurs spontaneously, although it is not totally random but "in harmony with the inner structure of the autopoietic unity" (Luisi, 2003: 54).

Maturana and Varela contest the notion that some living organisms are better adapted than others to their environment. An organism is either successfully structurally coupled, or it dies. As long as a living being is alive, it is adapted (Maturana and Varela, 1987: 114).

6.2.6 Different views on a system, and the assessment of behaviour

Apart from their training as biologists, Varela and Maturana shared a philosophical interest. Varela developed his interest in philosophy during a period at Harvard, and "European authors such as Husserl, Heidegger and Merleau-Ponty were particularly important for his work" (Luisi, 2003: 50). Mingers (1995) shows the similarities in thinking between Husserl and Maturana, as well as Heidegger and Maturana. According to Mingers, Maturana's use of the terms autopoiesis and allopoiesis are foreshadowed by Heidegger, and "many of the ideas of

autopoiesis bear strong resemblances to the phenomenology of both Heidegger and Merleau-Ponty" (Mingers, 2006: 36). The statements above indicate that Varela as well as Maturana was influenced by the school of phenomenology, and its interpretive world view. One of the places where this is evident is in the importance they place on the role of the observer when assessing the behaviour of a system.

Before getting to the role of the observer, a particular distinction that Maturana and Varela make between views on a system needs to be mentioned. The one kind of view considers the internal dynamics of a system, where structural changes are visible at component level, almost like that of a state machine. The other kind of view is the one from outside, where the system is observed as a unity within a particular environment, regarding it as a black box and focusing on its interactions with the environment. Maturana and Varela (1987: 136) provide the example of a person who has grown up in a submarine, whose world consists of operating instrumentation and who is guided by the feedback provided by the instruments. Such a person will not understand if someone from the outside tells them how successful their manoeuvres are in the underwater conditions. It is only the observer, who can see both the submarine and the environment, who can assess the ***behaviour*** of the submarine within a particular environment. However, two different outside observers, with two different frames of reference, will assess the behaviour differently. In other words, whether behaviour is regarded as adequate or not, always depend on the expectations of the observer. The destruction of the submarine may be acceptable to someone assessing destruction testing, but not to someone assessing the skills of the operator in stormy seas.

To summarise: not only are there different ways to regard a system, depending on whether one looks at the internal dynamics of a system or observes it from the outside; there are also multiple possible ways of observing. Interestingly, while Maturana and Varela recognise their own subjectivity, they take on a more positivist view when describing the inner mechanics of a living system, namely the view of biologists. They assume only one correct way of describing the chemistry of the nervous system, for example, while at the same time looking through the lens of autopoiesis theory. When it comes to observing a system as a unity within the context of its environment, they have a strong interpretive view, resembling the thinking of the above mentioned philosophers. However, this interpretive view has biological roots, as will be shown in the section below describing the nervous system, as well as the section on language.

6.2.7 The nervous system and cognition

One of the most basic functions of the nervous system is to assist in mobility, by connecting the sensory surfaces and motor areas in an organism, and providing a feedback mechanism that allows for constant correlation between these areas. In a more advanced organism with a central nervous system, the nerves attached to sensory surfaces have intermediate multiple links to an inter-neuronal network before connecting to the motor areas. The signal from sensory cells form only part of what determines the organism's response to sensory input: many other interconnections to other parts of the body as well as other parts of the nervous system are involved in determining the response. The nervous system, *connecting itself onto itself*, greatly expands the possible structural states and variety of responses to triggers from the environment as well as from within. The nervous system is an operationally closed system, a closed network of interactions that interprets triggers according to its own structure, and correlates and adapts that same structure in the process. What appears to an observer as effective behaviour and continuous learning, is simply a process of ongoing structural coupling with the organism's environment. ***Cognition*** is the ability to effectively act in an environment. Knowledge is displayed when a living system shows behaviour in accordance to what an observer expects to see. Knowledge is expressed in doing, and doing presupposes knowing, all as part of effective structural coupling (Maturana and Varela, 1987: 174).

6.2.8 Social systems

The material in the section that follows will be discussed in more detail, since social systems is the focus of this thesis.

The section on multicellulars indicated how single autopoietic cells can, through long-term structural coupling, form multicellulars, as second-order autopoietic unities. In the same manner, multicellulars, or organisms, can form long-term structural coupling bonds with other organisms to form social systems. These co-ontogenies, where individual organisms become dependent on each other and have a mutual recurrent influence, are termed ***third-order structural couplings*** (Maturana and Varela, 1987: 181). Although Maturana and Varela's views are not teleological, they do mention in a descriptive manner some important functions that are fulfilled by social structural coupling. These include sexual reproduction and the rearing of the offspring. In mammals, the task of breastfeeding results in the mother being more closely involved with the rearing of the offspring. In other animal types, there is no such general rule. For example, in some bird species, the father is more involved with the

offspring, in some bird species the mother, in some they each have a role, while yet in others they have a kindergarten arrangement where one parent takes care of all the offspring in the group. The same holds for bonds formed around sexual reproduction: some male-female bonds in animals are life-long and others just for the duration of sexual intercourse – there is no general pattern.

Maturana and Varela continue to discuss other kinds of third-order coupling, related to the behaviour of individuals belonging to a group. Such structural coupling usually lasts a lifetime. In the example of ants, chemical substances are continually exchanged to help reinforce and produce the variety of individual ant structures required by the colony. Ant larvae are the same when born, but the chemicals they are fed result in most developing into barren workers, with one fertile female or queen, and a few males – all with different social roles that are continually reinforced. An ant has to belong to a colony and will not survive for long on its own. In general, the social structural coupling of insects is very visible but also rigid, as determined by the shapes and limitations of their exoskeletons (Maturana and Varela, 1987: 188).

The social differentiation in vertebrates is less visible but more subtle and flexible than with insects, allowing for differences in personality as well as roles in the group. This advanced differentiation is enabled by the advanced nature and flexibility of their nervous systems, allowing for infinitely more structural "states" and variety than in the case of an insect. In general, the sophistication in social differentiation and coordination increases as the nervous systems of animals become more sophisticated.

Maturana and Varela refer to social phenomena as phenomena that arise spontaneously into third-order couplings, to constitute ***social systems*** (Maturana and Varela, 1987: 193). Individuals that participate all adapt structurally as part of the social system, and individuals are only part of the system as long as they remain part of the structural coupling process.

Communication is the coordination mechanism in social systems. Maturana and Varela's unusual notion of communication is about structural coupling rather than the transfer of information. The outcome of communication depends on the structural effect it has on the participating agents, rather than on the content of the message. Some communication is for the sake of coordination between particular individuals, in an immediate context. Maturana and Varela (1987: 194) provide the example of an African bird couple that sing a duet. The two birds sing complementary phrases that form a melody unique to the couple. The song

helps them locate each other in a thick forest. The unique melody only exists for the lifespan of the bird couple. More enduring coordinating mechanisms can be found in larger social groups. Such social habits are communicated by means of imitation, over generations. The collection of such habits that remain stable over the span of generations is termed ***cultural behaviour*** (Maturana and Varela, 1987: 201).

Another issue discussed by Maturana and Varela is that of "give and take" in a social system. Does an individual have to sacrifice its own interests for the sake of the social system? This is particularly relevant in life forms with a more sophisticated nervous system that allows for individual expression. According to Maturana and Varela, the one is not at the cost of the other. The adaptation/ structural coupling/ survival of the group occur at the same time as the adaptation/ structural coupling of the individual to its immediate environment (i.e. the group) for the sake of its own continuation. This is regarded as a balance rather than a contradiction. Maturana and Varela discuss different kinds of such "balances", which can be placed on a spectrum, from composite systems where members have no individual autonomy to where they have high autonomy. At the bottom of the spectrum is an organism, of which the organ-components exist purely for the sake of the organism and have no autonomy. This is followed by social insects, vertebrates, primates, restricted human social systems (with rigid rules governing behaviour) and lastly, human society in general. In human society, the members' freedom and autonomy is so high that it could be said that the society exists for the sake of its members rather than the other way round (Maturana and Varela, 1987: 199).

6.2.9 Language and self-reflection

Language is a result of humans' ability to reflect upon their coordinating social behaviour; humans have made abstract their means to communicate. Language provides a means to describe behaviour, including one's own behaviour. Anything that someone says, will be influenced by their own structure in observing, as well as their own structure in reflection – their own structure being the unique product of their own path of structural coupling. Here, we can see the biological roots of interpretivism.

According to Maturana and Varela (1987: 233), our human mental activity and self-consciousness are a result of our ability to express ourselves in language, and these again are closely related to people's structures and social structural coupling, enabling them to speak and to coordinate their conversations. The consensual domains formed by humans who coordinate their communication form an important foundation for human social systems.

While this is acknowledged, the social systems framework presented in Chapter 7 will not dwell in more detail on Maturana and Varela's work on language.

6.2.10 Autopoiesis, autonomy and sustainability

According to Maturana and Varela (1987: 48), living beings are autonomous, meaning that they specify their own laws. Maturana (1981) states that an autopoietic system is autonomous, but that autonomy does not imply autopoiesis. Luisi (2003: 51) notes that an autopoietic system is self-sustaining.

Zeleny (1997) has an extreme view, namely that a self-sustainable system should be autopoietic. This follows from his definition of sustainability, namely that "a system is sustainable if, through its operations, it expands or maintains the set of options and choices it has itself started with" (Zeleny, 1997: 251). Zeleny's view, which is argued from his strong definition of sustainability, is contestable: autopoiesis, as defined by Maturana and Varela, is a stricter notion than that of sustainability. An autopoietic system "arises spontaneously from the interaction of otherwise independent elements" (Varela at al., 1974: 192). However, as is the case in ICT for development, a system might arise and become sustainable through external intervention.

The researcher will stay with the view of Maturana, Varela and Luisi, namely that autopoiesis implies autonomy as well as sustainability, but not the other way round. It logically follows that if a system is not autonomous or not sustainable, it is not autopoietic.

6.2.11 Conclusion

Maturana and Varela in their autopoiesis theory present a notion of a system that is drastically different from conventional system notions. The autopoietic system does not transform anything except itself. It does not have "inputs", it can be called "information-closed" (Dell, 1985: 6; Morgan, 1986: 238). Its changes over time are a result of continuous adaptation to its environment. While it responds and adapts as a result of each trigger from the outside (as well as triggers from the inside), these responses are determined by its own structure. Human cognition, mental activity, self-reflection and language all result from our individual internal structures and their social structural coupling. Behaviour is always assessed from the point of view of an observer, who is himself uniquely structurally determined. Hence, all observations are subjective.

In addition to the autopoietic organisation of a single living cell, with its first-order structural coupling, Maturana and Varela discuss composite unities, namely multicellulars and social systems, together with the respective concepts of second- and third-order structural coupling. Although they do not state that composite unities, and in particular social systems, are autopoietic, they proceed to apply autopoiesis theory to investigate these composite systems.

Apart from the notion of autopoiesis, the concepts of autonomy and sustainability are available to investigate the success of a system's ability to maintain itself and to interface with its environment. In the application area of ICT4D, where sustainability is an important issue, the theory and principles presented above could make a contribution when attempting to understand the underlying systemic issues related to sustainability.

6.3 Application in the social domain

The potential value of using autopoiesis in a social context[5] is discussed by Mingers (2002: 281; 2006: 168-170). Firstly, the notion of an autopoietic system is more suited to a social system than the traditional systems definition. A traditional systems view will focus on inputs, functions and outputs. However, a social system does not necessarily produce or transform something, and may not be concerned with its own functions or even its inter-relations with other systems. An autopoietic system's organisational closure means that these traditional systems aspects become less relevant, and, as Mingers puts it, its goal is purely its own self-production. Secondly, the autopoiesis theory's distinction between organisation and structure means that a system can change dramatically over time (in terms of its structure and membership) without losing its identity (which is in its organisation). Further, structural determinism implies that the origin of change is the system itself, and not its environment. According to Mingers, this is preferable to views that regard systems at the mercy of their environment, as if it were the environment that determined the system. The autopoietic notion of structural coupling provides an alternative, more equitable way of studying the mutual influence between system, environment and other systems. Mingers also mention a few other benefits, such as with regard to legal theory, which are not perceived to be directly relevant to this study.

Varela (1981: 38) does not believe autopoiesis can be directly applied to social systems. According to Luisi (2003), Maturana is more receptive to the idea. Kay (2001) gathers from

[5] A limited portion of this discussion has appeared in Turpin (2009).

Maturana and Varela's writings that neither believes autopoiesis can be directly applied to social systems, and they do not provide consistent suggestions as to the way forward. Kay also states that a lot of debate has taken place around the topic in the systems community with few useful outcomes to show.

Despite the scepticism, debate and lack of consensus about its wider applicability, autopoiesis has been applied in chemistry (Luisi, 2003) as well as a range of social domains. These include law (Teubner, cited in Luisi, 2003), literature (Paulson, cited in Luisi, 2003), family therapy (Efran and Lukens, 1985), social work (Bilson, 2007), the economy (Zeleny, 1997), information systems (Córdoba and Midgley, 2006; Winograd and Flores, 1987) the business organisation (Kay, 2001; Limone and Bastias, 2006; Radosavljevic, 2008) and society at large (Luhmann, 1990; 2006; Gregory, 2006; Vanderstraeten, 2005). Luisi (2003) believes the social application of autopoiesis has been a surprise and remains exciting.

6.3.1 Attempts to develop a social autopoiesis theory

Several suggestions have been made for ways to apply autopoiesis theory to social systems. Some authors are satisfied with a metaphoric application (Morgan, 1986), while others concern themselves with the question of whether social systems are, in the ontological sense, autopoietic (e.g. Kay, 2001; Mingers, 2002; 2004; Radosavljevic, 2008). Kay (2001) distinguishes the following streams of thinking: a "scientistic" stream, characterised by the work of Zeleny and Hufford (1992), a sociological stream, characterised by the work of Luhmann (1990), and a metaphoric stream, to which Morgan (1986) contributed. In addition to the streams mentioned in Kay (ibid.), Kay has made an own contribution, based on the work of Hejl. Subsequent to the publication of Kay's review paper, Mingers (2002; 2004; 2006) has also made a theoretically significant contribution, suggesting a conceptualisation that incorporates the social theory of Bhaskar and Giddens. The different lines of thinking of the above mentioned authors will be discussed.

6.3.2 The "scientistic" stream: Zeleny and Hufford

Zeleny and Hufford (1992) make strong claims about the social applicability of autopoiesis, but these claims have been equally strongly criticised. It appears that much of the early resistance against the social application of autopoiesis (e.g. Mingers, 1992) stems from Zeleny and Hufford's claims.

Varela et al. (1974) present six criteria for a system to be classified as autopoietic. These criteria assess whether one can, for a particular system, clearly determine a boundary, constitutive components, self-producing internal relations, whether the boundary is constituted by these relations and so forth. Zeleny and Hufford (ibid.) apply these criteria to a eukaryotic cell, an osmotic membrane and similarly to a human family. They argue that the family constitutes a "spontaneous social order" and is an example of an autopoietic system, "produced and maintained through organisational rules… of a given society" (Zeleny and Hufford, 1992: 155). They proceed through each of Varela et al.'s criteria, arguing that a family has a well defined boundary, clearly identifiable components, produced by means of family interactions, and so continues to respond to each of Varela et al.'s criteria. Mingers (1995: 126) works through Zeleny and Hufford's argument and refutes every single one of their claims. He questions the notion of a neatly defined nuclear family with clear boundaries, and finds it easy to provide counter-examples. He questions the existence of boundary components and their participation in autopoiesis. He also shows that there is confusion between what occurs in the biological/physical and what in the social domain, and notes this confusion as the central problem of the paper. Zeleny and Hufford (1992: 156) conclude that "all autopoietic systems are social systems". This Mingers (1995) takes to be a distortion of the notion of "social".

Following from Mingers' identification of a central problem in Zeleny and Hufford's work, Kay (2001) also notes that whether a social system exists in the physical or non-physical space is a central issue in social autopoiesis. Mingers infers from Maturana's thinking that "an attempt to describe social autopoiesis must locate it entirely in the social domain" (Mingers, 1995: 128).

Another possible view on Zeleny and Hufford's claims is that they are pragmatists rather than being unscientific. Zeleny is an operational researcher who might be interested in the practical value of the application of a theory rather than in keeping all his critics happy. Robb (1985) and Beer (1979, cited in Mingers, 1995) are other proponents of social autopoiesis who could be placed in this category, recognising practical value from a direct application of autopoiesis in the social context. They also happen to be active in the operational research field. Mingers (1995: 120) calls this kind of approach "naïve", since the authors did not concern themselves with the underlying conceptual problems of social autopoiesis.

6.3.3 Luhmann's social theory

Niklas Luhmann, a major German sociologist, developed in the 1980s an entire social theory based on autopoiesis (Mingers, 1995). Of all the contributions on social autopoiesis, Luhmann's theories appear to be the most extensively developed, discussed, criticised and applied. Influences on Luhmann's work include general systems theory and the functionalist work of Parsons, with whom he studied. Luhmann is also known for his published debates with Habermas (Mingers 1995). Luhmann's work on social autopoiesis, that appeared later in his career, is particularly influenced by Spencer Brown's theory of distinction, in addition to Maturana and Varela's autopoiesis theory (Seidl and Becker, 2006). Of Luhmann's vast body of work, only elements of his work on social autopoiesis will be discussed below, together with some of the surrounding critique.

Luhmann (1990) departs with the statement that autopoiesis theory is not a general systems theory. As conceived by Maturana and Varela, it only applies to particular kinds of systems, notably living systems. Luhmann attempts to take autopoietic principles to a higher level of abstraction where they could also apply to non-living systems. He holds that most generally, autopoiesis refers to any system of which the elements are (re)produced by its own elements (Seidl and Becker, 2006). According to this broad definition, he specifies three types of autopoietic system: living, psychic and social. The latter two are non-living systems (Luhmann, ibid.).

In Luhmann's conceptualisation of social systems, the mode of reproduction is *communication*. The social system contains only the network of communications and nothing else: not humans, nor actions or thoughts. This definition of a social system enables Luhmann to place the social system as well as its components and production process in the same non-physical space (Mingers, 1995). Communication, as used by Luhmann (ibid.), is an abstract notion defined different from its conventional use. A communicative event has three aspects, namely information (content), utterance (the way and motive of conveying the information) and understanding (including misunderstanding). Such an event is instantaneous and only exists while the utterance is conveyed. It only has importance insofar as it leads to a new communicative event. If the next communicative event is concerned with the information aspect of the previous communication, it is called hetero-referential. If the next event is concerned with the utterance aspect (such as who said it, or why was it said), it is auto-referential (Luhmann, ibid.). Luhmann emphasises that the three communicative aspects do not exist independently (although they can be analysed as such); they can only be regarded as

part of an ongoing process of communication. Communication requires at least two humans in order to take place. However, Luhmann separates the notion of communication from the participating people and focuses his theory on the event and its influence on further communication (Seidl and Becker, 2006).

According to Luhmann, modern-day society's network of communication includes the following subsystems: political, economic, scientific, education (Luhmann, 1990: 177), religion (1990: 144), law (p 225) and art (p 191). The functional differentiation of society into increasingly autonomous subsystems is a way to increase its internal variety, in response to the increased complexity of its environment (Mingers, 1995: 140). Each subsystem has its own code and rules that determine what qualifies as acceptable communication. For example, the legal system specifies legal vs. illegal, and what would count as acceptable information, utterances and understanding, e.g. respectively, legal contracts, a judge's way of ruling and the way previous rulings are interpreted. For each subsystem, all that exists is its own network of valid communications over time (Seidl and Becker, 2006: 16). Here, one can see Spencer Brown's theory of distinction applied: what is distinguished as "valid" by the system (as observers of themselves) is recognised as elements of the system. One can see that such a system has no boundary elements; only a membership of distinction vs. "everything else" (Seidl and Becker, 2006: 18). What counts as valid elements of a system may change over time (Mingers, 1995: 147).

Subsystems, although independent in their language of communication, are functionally co-dependent. They can trigger changes in each other, for example a scientific discovery can trigger economic and legal communication. In this way, they are structurally coupled. Mingers (1995: 146) provides an overall social systems picture, with society consisting of the interconnected subsystems, plus an enveloping "lifeworld" that contains everyday communications not belonging to particular subsystems. Around this social system of lifeworld and subsystems, Mingers draws a boundary. The system's environment, according to Mingers, contains "everything else", including humans, actions and thoughts. King and Thornhill (2003: 281) contest Mingers' representation on at least two grounds. They do not find evidence of the existence of a lifeworld as part of the social system in Luhmann's theory. They interpret Luhmann to mean that everyday conversations can only be recognised as communications once they are valid contributors to a particular subsystem. Further, the environment of the subsystems is not a common one: every subsystem only recognises itself as distinguished from "everything else"; that "everything else" is different for each subsystem

(King and Thornhill, 2003: 283). One can see that it is difficult to draw a neat systems picture of Luhmann's social theory, as Mingers attempts.

How do humans relate to Luhmann's system of communication? One of the three kinds of autopoietic system Luhmann defines, is the psychic system or human mind. Psychic systems have thoughts as elements of their autopoietic production process: thoughts producing thoughts (Seidl and Becker, 2006: 17). Psychic systems (representing individuals) and social systems are operationally separate but structurally coupled. Luhmann refers to a special relation between the two, namely interpenetration: they have a strong mutual influence, as if they were part of the same system (Seidel and Becker, ibid.). The mind "has the privileged position of being able to disturb, stimulate and irritate communication. The mind cannot instruct communication, because communication constructs itself" (Luhmann, cited in Seidl and Becker, 2006: 22). The social system depends on the psychic system, among other, to interpret information and trigger new rounds of communications. Social systems cannot exist without psychic systems, and communication cannot occur without humans.

Apart from society as the all-encompassing social system, Luhmann distinguishes between two other kinds of social system, namely (face-to-face) interaction and Organisation[6]. These two are also based on communication, but a particular type of communication each. In the case of interaction, it is "communication based on the participants' mutual perception of their presence" (Seidl and Becker, 2006: 24). The autopoietic production elements of Organisations are decision communications. Luhmann proceeds to reframe Organisational decision-making by means of his autopoiesis-related theory base. In this way, he paves the way for a different way of thinking to be applied to the study of Organisations.

6.3.3.1 Critique on Luhmann's work

Mingers (2002) has two main concerns with Luhmann's theory, of which the key notions are italicised below. Mingers' first concern is with communication as the autopoietic production process. Communication cannot happen without people - and people have been removed from Luhmann's social system in order to frame it entirely in the non-physical domain. Communication can lead to more communication but cannot produce it. Mingers recognises that Luhmann's notion of interpenetration goes some way towards describing the role of

[6] Organisation is written here with a capital letter, with reference to a firm, and to distinguish it from Maturana and Varela's notion of organisation.

humans in producing communication, but it does not explain it. Mingers' second overall concern is with the system boundaries. Luhmann successfully demarcates what counts as communication and what not, also for the subsystems of law, science and so forth. Theoretically, this is satisfactory but in practice not: can real-life communication be so neatly classified into the subsystems? People's behaviour, that gives rise to communication, is multi-faceted and does not respect subsystem boundaries. Similarly, the real-life Organisation is much more varied than only being a decision-making mechanism. An earlier version of Mingers' critique lists additional concerns, such as the absence of boundary elements active in the self-producing process (Mingers, 1995). However, Mingers (2002) appears to capture his main concerns, which remains the same in Mingers (2006).

King and Thornhill (2003) react strongly against Mingers' critique, arguing that Mingers misinterpreted Luhmann. They remind the reader that Luhmann reconceived the notion of autopoiesis to be more general and abstract, so that it is not the same as Maturana and Varela's notion of autopoiesis. Seidl and Becker (2006) also note that Luhmann has been widely criticised, often as a result of not understanding the nuances of his theory.

Despite the controversy around Luhmann's social theory, it remains a topical area of study and discussion, as can be seen in the work of Elder-Vass (2007), Gregory (2006), Vanderstraeten (2005), Seidl and Becker (2006), Hertig and Stein (2007), Morner and von Krogh (2009) and Mavrofides et al. (2011).

6.3.4 The use of autopoiesis as a metaphor

Morgan's work is representative of a metaphoric use of autopoiesis, applied to Organisations (Mingers, 1995; Kay, 2001). According to Kay, this is the least problematic of the views on social autopoiesis. Morgan (1986) presents three arguments related to autopoiesis in an Organisational context. The first is that when Organisations do planning, they actually do self-reflection or self-assessment. They create an image of themselves and project it onto the business environment in order to inform their actions. The way they describe the business environment is determined by their own interests. When they intervene in the environment, it is in order to (re)create or produce themselves. Mingers (1995: 151) notes that such behaviour reflects the structurally determined way of observation performed by Organisations. Morgan's second point is that Organisations, in this process of producing self, should not be overly egocentric but also notice the changing environment with which they interact. Their survival depends on successful relations with the environment and not just on self-production against a

given backdrop (Morgan, 1986: 243). In autopoietic terms, their structure needs to be one that can maintain structural coupling with the environment. Organisations need to realise that their structure can be adapted without having to sacrifice their identity (Mingers, 1995: 151). Morgan's third point is that Organisations are often over-protective of their identity, or define it too narrowly, which is costly to themselves and their environment in the longer term. Organisations are fellow custodians of a bigger system that even includes their competitors. Their identity should remain open enough to allow the successful co-evolution of the larger system (Morgan, 1986: 246).

Morgan manages to capture something of the underlying spirit of autopoiesis and show its implications for Organisations. Mingers comments that Morgan's metaphoric use of autopoiesis saves him from the agony of ontological concerns. However, Mingers concludes that the results of this metaphoric application are equally metaphoric and do not carry much weight (Mingers, 1995: 152). Luhmann and Varela are of similar opinion (Kay, 2001: 467). However, Kay points out that theorists should be careful in their criticism of the use of a metaphor, which is a way of seeing, since a social system itself is only a "way of seeing things" that is construed by an observer, using Checkland's definition. If a social system is not a literal entity, how can it be literally autopoietic? Kay argues that Mingers' criticism is "over-dismissive", and that the value of a metaphoric (or any other) approach should rather be measured against a person's reason for using it in the first place. Kay believes the concepts of autopoiesis are useful to apply regardless of whether one believes a social system is autopoietic.

6.3.5 The work of Hejl and Kay

According to Hejl, society is "the process in which individuals interact with one another and with their natural environment under the primacy of self-preservation" (Hejl, cited in Kay, 2001: 470). From this, Kay (ibid.) notes that central to Hejl's notion of society are humans, their natural environment and self-preservation. Together with the latter term, Hejl draws in concepts from evolution, consistent with Maturana and Varela's thinking. As such, Hejl's notion of socialisation refers to ontogenic structural drift. However, since humans can create external realities for themselves, environmental triggers sometimes originate from within their own created realities. On the one hand, this may be dangerous, such as with a paranoid person, but it also helps humans to increase their structural variety, such as with a marathon athlete who applies mental conditioning to improve her performance. Kay (ibid.) continues in this manner to elaborate on Hejl's work and adds some conceptualisations of his own.

The importance of Hejl and Kay to this thesis lies not so much in their conceptualisations but in their view and use of autopoiesis. According to them, social systems are not autopoietic. The membership of human components to a social system are too non-committal and people could be members of multiple social systems at once. Another interesting point is the way Hejl chooses to define boundaries: boundaries of a social system are construed through the interactions of the people (as components) within the system. To determine the boundary, one has to observe the system and hear from the involved people how they would define the system (Kay, 2001: 471).

Hejl and Kay represent examples of theorists who recognise value in applying concepts from autopoiesis to society, on the one hand trying to remain true to Maturana and Varela's original thinking while on the other hand not finding it necessary to claim that social systems are autopoietic.

6.3.6 The contribution of Mingers

Mingers (1995; 2002; 2004; 2006) is very careful about the social application of autopoiesis. He scrutinises and critiques the attempts of Zeleny and Hufford, Morgan as well as Luhmann, before exploring some notions of his own. Mingers (2004) investigates the use of the social theories of respectively Bhaskar and Giddens, for describing self-producing social systems. Both these theorists are concerned with the "continual self-production of society" (Mingers, 2004: 403).

Giddens' structuration theory is introduced and discussed in Chapter 5. Mingers quotes Giddens as follows: "human social activities, like some self-producing items in nature, are recursive", and "by its recursive nature I mean that the structured properties of social activity – via the duality of structure – are constantly recreated out of the very resources which constitute them" (Giddens, 1984, cited in Mingers, 2004: 406). Further similarities between autopoiesis and structuration theory include the following (Mingers, 2004):

- They are both based on non-functionalist and non-teleological views;
- Both have a way of recognising physical as well as intangible constructs, Maturana with structure and organisation, and Giddens with system/social practices and structure; and
- Both have a relational view of systems, specifying three sets of relations or differences, namely the *when* (spatial), *where* (temporal) and the *what*.

Whereas Giddens is a sociologist who attempts to reconcile objectivist and subjectivist views of society (Mendelsohn and Gelderblom, 2004), Bhaskar is a philosopher and a critical realist. Bhaskar has developed a model based on critical realism, called the Transformational Model of Social Activity (TMSA) (Bhaskar, 1979, cited in Mingers, 2004). Bhaskar proposes that there are structures or mechanisms underlying our entire existence, which are ontologically *real*. These structures cause events to occur (in the natural as well as social world), in a domain he terms the *actual*. People are able to observe a subset of the actual, called the *empirical*. Society is a real structure, but not unchanging, and observable empirically through social activity. There is a reciprocal influence over time between society and social activity. Society consists of social "structures, practices and conventions, where structures are relatively enduring mechanisms that govern social activities" (Mingers, 2004: 409).

Bhaskar's structure and agency appear in a dualism (they are separate entities), as opposed to Giddens' agency and structure which are a duality, or two sides of the same coin. Further, in comparison to Bhaskar's realist position, Giddens' theory includes some subjectivism when it comes to his view on structure. Overall, Bhaskar's conception of structure is a stronger one than that of Giddens: it has an ontologically real, separate existence and is a generating mechanism for social action. However, in both theorists' views, there is a mutual influence between structure and social activity.

Mingers concludes that Bhaskar and Giddens' thinking is compatible enough to allow for a synthesis of their key concepts, phrased as follows: "Social structures, consisting of position-practices, rules and resources, are generating mechanisms that, through their complex interactions, enable and constrain observable and social activity which in turn reproduces and transforms these structures" (Mingers 2004: 416). According to Mingers, it follows that society is a combination of activity and structure that is temporally situated.

Mingers subsequently tries to assess whether the synthesised Bhaskar/Giddens thinking lends itself to an application of autopoiesis to the social domain. He suggests that the best candidate to describe the components of the social system would be the social structure. Since social structure is (re)produced by social activity, such human activity needs to be included in the processes of production. However, action and structure form a duality. The processes of production, or organisation of a social system, are best described by Giddens' process of structuration.

After having specified the autopoietic production processes and components, Mingers (2004: 417) investigates the requirement of organisational closure. One would need to show circular feedback loops in the processes of production, creating implicit boundaries. Since social activity as well as social structure is present in the production process, both aspects need to be part of the feedback loop: activity needs to reproduce the structure that influences it. Mingers state that such causal loops abound in society, for example families, religions, sports clubs or even Western capitalism. However, these social systems can seldom (if at all) be isolated from the intricate network of processes and loops that underlie the wider society. It will be difficult to find current-day social systems which are truly self-contained. To Mingers, this is the only factor keeping his formulation of a social system from being autopoietic.

6.3.6.1 Discussion of Mingers' social system

Using the social theories of Giddens and Bhaskar, Mingers produces a fairly straightforward and elegant way of applying autopoiesis to social systems. The theories of Giddens and Bhaskar manage to capture something of the essence of a social system, as opposed to a biological, mechanical or other kind of system. Mingers finds a conceptually sound way to apply the principles of autopoiesis to a systems notion that is essentially social. However, Mingers' application raises a few theoretical concerns that have been noted during previous criticisms of social autopoiesis. Since these are central concerns of social autopoiesis, they will be discussed in more detail below.

The first concern is that of the space (or domain) in which social autopoiesis should occur. Maturana and Varela's notion of autopoiesis is characterised fully in the physical space. Zeleny and Hufford (1992) describe a family as being autopoietic, referring to biological as well as social characteristics. The authors are criticised for confusing the physical and non-physical component space. A requirement is subsequently stated that autopoietic production should be consistently in the same space (Kay, 2001). Mingers responds to Zeleny and Hufford as follows: "any attempt to describe social autopoiesis must locate it entirely within the social domain" (Mingers, 1995: 128). Luhmann removes human activity from his autopoietic system of communication, so that his system is entirely in the non-physical domain. He is criticised by Mingers for doing this, since how can communication occur without humans? The dilemma is clear: one cannot do right by including or excluding human activity. However, it appears that the issue is whether the nature of human activity is biological or social. Mingers includes human activity as well as tacit social structure in the autopoietic production process. While human activity plays out in the physical space, its

nature is social, and therefore in the "social domain". Hence, Mingers' conceptualisation all fits in the social domain.

The second concern refers to the nature of the boundary of a social system. Varela (1981) states that autonomy and organisational closure can possibly be shown in social systems where the relations that define them do not involve the production of (physical) components. However, they cannot be termed autopoietic. An autopoietic system requires boundary components that actively participate in the production process. Mingers (1995) criticises Luhmann for only defining a boundary of distinction (specifying what is inside and outside), since it does not have boundary components. He also criticises Zeleny and Hufford for defining a "membership-type boundary" that does not play a role in autopoiesis. However, the boundary created in Mingers' conceptualisation is *also a boundary of distinction*. Mingers (2004) now appears to justify a boundary of distinction for the social domain with his interpretation of Varela. It is possible that he became more realistic as to what is feasible in the case of a social system.

The third concern is the requirement of organisational closure. Mingers (1995) criticises the boundary distinction provided by Luhmann for societal subsystems by stating that in reality, a social system cannot have a clearly drawn identity. Mingers admits that this remains a problem with his own conceptualisation as well. Social systems are not and cannot be organisationally isolated. According to the researcher, this is a reflection of the nature of social systems and any theory that makes such an assumption will only be able to formulate its social system as an "ideal type".

6.3.7 Fuchs' use of Giddens

Prompted by Mingers' (1995) discussion of the similarities between structuration theory and autopoiesis theory, Fuchs (2003) develops a seemingly independent argument for the combination of the two in the social domain. Fuchs' departure point is that of complexity theory, where the term "self-organisation" is used to describe emergent behaviour in thermodynamical systems. Fuchs uses "self-organising" also in reference to autopoiesis, which he classifies with complexity theory. Such an association is problematic, as discussed in Section 4.7, which deals with complexity thinking. Fuchs' substitute phrase of "self-organising systems" for "autopoietic systems" is in particular problematic. In the way which Maturana and Varela use the term "organise", autopoietic systems are not self-organising. "The organisation of a system… specifies the class identity of the system… if the

organisation of a system changes, then its identity changes and it becomes a unity of another kind" (Maturana, 1981: 24). An autopoietic system does not have the ability to change its own defining characteristics from within. Over time, structural drift (through structural coupling) and phylogeny leads to evolutionary change, but this is still not the same as Fuchs' notion of "self-organising" from complexity theory. Fuchs directly transfers the notion of self-organising, meaning autopoietic, to social systems. Here, he recognises the contribution of Luhmann. He criticises Luhmann's theory for its dualistic distinction between human activity and society, and for his neo-functionalist approach. He prefers Giddens' duality of structure, where human activity and social structure are inseparable. Fuchs provides a detailed discussion of Giddens' social theory to show its compatibility with the underlying thinking of complexity and emergence, as opposed to the thinking of the competing paradigm of "functionalism", "dualism", "reductionism" and "determinism" (Fuchs, 2003: 161). Fuchs' argument is possibly simplistic, for example by not recognising the structural determinism in autopoiesis. However, it reveals the overall compatibility between the way Giddens portrays social systems and the recent understanding of physical, chemical and biological systems.

6.3.8 A spectrum of social applications

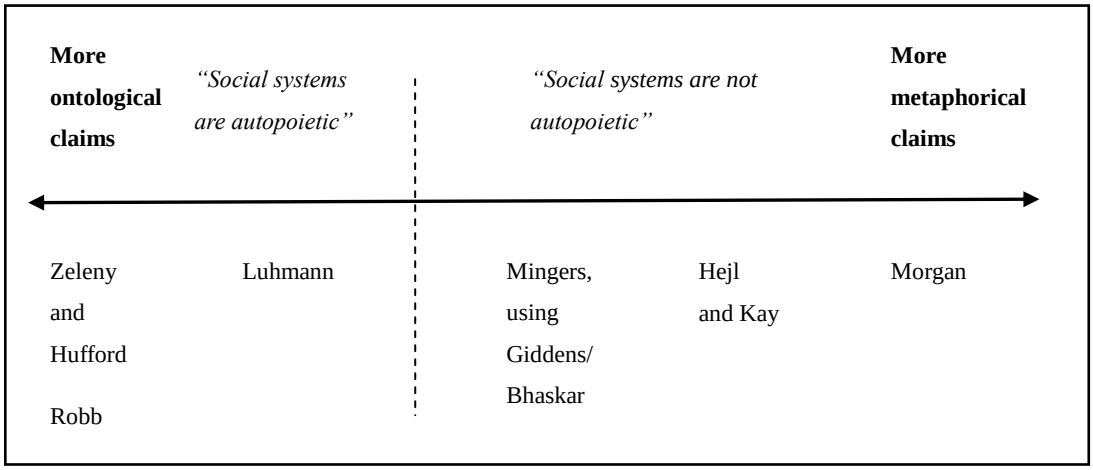

Figure 6.1: A spectrum of positions on social autopoiesis

Figure 6.1 shows a selection of authors on social autopoiesis, and their relative positions on the applicability of autopoiesis to social systems. Towards the left are Zeleny and Hufford, who claim that social systems are autopoietic in an ontological sense, without any qualifiers or re-conceptualisations. Towards the other extreme is the purely metaphorical application of Morgan. The authors in between can be broadly classified in two camps: those who claim that

social systems can in some way be regarded as autopoietic, and those who claim that this is not possible. Despite their reservations, the second group recognise the value in autopoietic concepts and play around with ways to possibly (or actually) apply them in a social context. This is where the similarities end: the grouping of theorists together in a camp does not imply that their respective theories are at all similar.

6.3.9 Reflection

The literature on the social application of autopoiesis presents a variety of arguments about whether and how autopoiesis should, or should not, be applied in the social domain. The voices against the view that social systems are autopoietic in an ontological sense, include concerns over the physical vs. non-physical space of components, the production process, the definition of boundaries and active boundary components, and the dilemma of an operationally closed human system. However, as shown during the discussion on Mingers' theory, the critique on attempts towards social autopoiesis has become somewhat more moderate. It appears that too strict requirements on a social autopoiesis theory are generally not helpful, and one needs to make some allowances for the differences in nature between a social and biological system.

While the theoretical debates continue, there is evidence of authors who boldly (but not carelessly) apply the principles of autopoiesis in their respective fields and find value from it. Autopoiesis enables them to generate new insight in their fields of study and add value to the existing body of theory in their respective subject fields. Examples are Maula (1999), Lambropoulou (1999), Córdoba and Midgley (2006) and Bilson (2007).

To illustrate this point, and to simultaneously provide an example of how autopoiesis has been applied previously in the IS domain, Córdoba and Midgley's (2006) work is discussed. Córdoba and Midgley (ibid.) combine concepts from autopoiesis and critical systems thinking (CST) when conducting a participative IS planning exercise in Columbia. They portray humans as autopoietic systems whose knowledge bases, values and beliefs are uniquely structurally determined, and are based on the individual's physical attributes and path of development. Second, through structural coupling by means of language, humans form consensual domains for interaction. In a CST context, the implications are as follows. The notion of structurally determined uniqueness should lead to an ethical awareness of the limitations of our own knowledge, and acknowledging as equally valid the views of others. Further, through structural coupling by means of conversation we can create new mutual

understandings, allowing for new consensual domains to develop. Córdoba and Midgley introduce a critical methodology for IS planning, that interchangeably moves between 'distinction' (identifying different unique views), 'dialogue for improvement' (conversation towards mutual understanding) and 'boundary critique' (a CST notion looking to acknowledge marginalised parties and issues). They discuss the implementation of this methodology in the context of carrying out IS planning at a university in Columbia, and show how the critical approach manages to include concerns and views far beyond those of a traditional IS planning approach. In terms of their application of autopoiesis concepts, Córdoba and Midgley take the view that humans are autopoietic, proceed to identify particular autopoiesis concepts that add value to their CST methodology, and in their application indicate how it adds value.

In addition to the above mentioned social applications, it is inferred from the writings of a number of authors that the principles of autopoiesis can indeed be applied to a social system *without having to claim upfront that the system is autopoietic or even organisationally closed* (e.g. Maturana and Varela, 1987; Mingers, 2006; Kay, 2001; Morgan, 1986). "Regardless of whether social systems are autopoietic or not, the ideas underpinning autopoietic theory could provide useful tools to conceptualise, model and help make decisions" (Kay, 2001: 468). Mingers, after much consideration, comes to the conclusion that the acceptance of social autopoiesis will depend not so much on its absolute truth but "on its effectiveness, its usefulness, as part of an ongoing conversation among observers" (Mingers, 1995: 205).

When deciding whether to apply autopoiesis socially, it appears that the potential benefit needs to be weighed against the theoretical challenges that might be faced in the process. Also, a pragmatic approach that focuses on the sound application of the basic underlying principles of autopoiesis, taking note of but not trying to satisfy each previously voiced requirement, might be more achievable.

6.3.10 Way forward for a systems framework

Not all of the theoretical suggestions towards social autopoiesis have been applied in practice. One of these is Mingers' suggestion of using a structuration-based social theory to describe the social system to which autopoiesis is applied. As shown by Mingers (2004) and discussed above, structuration theory and autopoiesis resonate well. The same point is argued by Fuchs (2003). The use of a structuration-based theory to model the social system is satisfactory from a sociological point of view: it well reflects the social nature of the system. At the same time,

it provides the opportunity to gain insights into the systemic nature of the social system by applying autopoiesis principles.

When social autopoiesis is included as part of the systems framework in a following chapter, the ontological claim will not be made that social systems "are" autopoietic. As argued above, the concepts related to autopoiesis can be applied to the social domain without making such a claim. Nevertheless, it is proposed that the use of a structuration-based theory to describe the organisation of a social system, provides a stronger theoretical foundation than when autopoiesis is applied in the purely metaphorical sense.

6.4 Conclusion

Maturana and Varela's work presents a revolutionary way of thinking about the definition of life, as well as autonomy, sustainability, cognition, communication and knowledge. This way of thinking includes the notion of a system. Autopoiesis' social application is controversial and contested, but at the same time has given rise to new insights in a number of fields. While addressing the research question:

- What is the value of the theory of autopoiesis when applied socially?

It has been found that despite the theoretical controversy around social autopoiesis, a number of authors have found value from applying its basic principles in the social domain. It has been argued that that the principles of autopoiesis can indeed be applied to a social system without having to claim upfront that the system is autopoietic or even organisationally closed. After having conducted a study on the value of social autopoiesis, the researcher believes that the questions around its theoretical applicability have been resolved, and she can proceed to apply it empirically to a social system. However, before proceeding to apply it, a framework still needs to be developed for its practical application. This framework is presented in Chapter 7 that follows.

Chapter 7 Social systems framework

7.1 Introduction

In this chapter, the social systems theory selected in Chapter 5 is developed and discussed further. In Chapter 5, it was discussed and motivated at conceptual level only. Here, it is developed into a social systems framework, with which to address the research question:

- What is an appropriate social systems framework with which to study the impact of an IT intervention in a remote, rural African community?

The social systems framework embodies the systems theory and concepts to be applied, and it suggests the elements to be used for data collection as well as analysis. The two main components of the systems framework are structuration theory, which will be used to describe the socially based self-producing mechanisms of the system, and the theory of autopoiesis. Structuration theory and autopoiesis theory are combined making use of Mingers' (2002; 2004; 2006) suggestions on the use of autopoiesis in social systems.

The social systems framework is a culmination of several previous sections of the study. The framework makes use of theory that has been covered in Chapters 4 to 6, in particular, Giddens' structuration theory from Chapter 5, the theory on social autopoiesis from Chapter 6, as well as limited aspects of Checkland's SSM, discussed in Chapter 4. The framework also draws on the general systems and modelling background of the researcher, who has been involved in the field of Operations Research for many years. A motivation for using this combination of principles is presented in Chapter 5, using the suggested criteria for selecting a social systems framework.

In addition to building on previous sections, the framework lays the basis for the empirical chapters to follow. As such, it is forward looking, anticipating the collection and analysis of data, some of which have been done, in the hermeneutical style, parallel to and informing the development of the systems framework.

The elements of the framework are all developed to eventually address the problem statement as discussed in Chapters 1 and 2: The framework is designed to assist in describing the social structure of the systems of interest, in order to assess not only their individual self-producing

ability and sustainability but also mutual influences, so that the influence of the ICT4D system on its systems served can accordingly be assessed.

This chapter is organised as follows. It departs with a section describing the preparatory work to be done as part of the systems exercise. The pre-work entails a background study on the social systems of interest, as well as stating assumptions and simplifications made as part of the modelling exercise. The systems model is subsequently presented. The elements of the model are introduced, and their application to the case study is discussed and selectively illustrated by examples.

7.2 Preparatory work: background and assumptions

Before embarking on modelling a system, some preparation is required. Firstly, background information on the situation needs to be obtained, and secondly, the modelling assumptions need to be stated.

7.2.1 Background sketch on the community

Generally, background information on the system of interest needs to be collected. In Checkland's Soft Systems Methodology, the first of the four major activities entails "finding out about a problem situation, including culturally/politically" (Checkland, 1999: A15). Checkland suggests drawing a rich picture. For each conceptual system that is further developed, a root definition is sought, considering the aspects of the CATWOE mnemonic, namely Customers, Actors, main Transformation, World view, problem Owners, and Environmental constraints (Checkland, 1999: 224; see also Chapter 4). Daellenbach and McNickle (2005) suggest a similar way of starting, including a rich picture, followed by specifying the system of interest (and implicitly the boundary) and listing who the problem owners, decision maker(s), analysts and customers are. A general background sketch is in any case required as part of an interpretive field study, as suggested by Klein and Myers (1999). They refer to the "principle of contextualisation", that requires the background and history of the case setting to be provided (Klein and Myers, 1999: 72). Hence, this is a general requirement of the research method, as well as the natural starting point of a systems approach.

In this study, the principle of contextualisation is applied by performing a background study of the overall case setting, followed by a contextual study of each social system identified in

the case. The essence or root definition of each system is distilled by means of a CATWOE description. According to Checkland and Holwell (1998:164), developing root definitions can be part of systems design ('mode 1' use of SSM) or a reflective process ('mode 2' use). In this framework, they would be part of the researcher's sense-making and are therefore reflective.

7.2.2 Assumptions and simplifications

When moving from the real world to the conceptual systems world, some assumptions and simplifications need to be made. A systems description is a simplified version of the real world, some elements of which are selected to be included as system components and processes. These elements are selected to represent the situation, and chosen in line with the aims of the modelling exercise. Generalisations are made about these components: for example, if there is a "manager" in the systems model, he/she is assumed to have a standard set of characteristics, the same for all "managers" in the system. Generalisations related to a system based on the Zulu culture may mean that similar habits are assumed among all people practising that culture, within the system boundaries. As such, an ideal type of the Zulu culture is created, in order to simplify the description and analysis. When using a theory in research, assumptions and generalisations are similarly made. A selection of real world aspects are chosen as focus areas, and the interplay between these are studied in a specific way. When using a social theory based on autopoiesis, some particular aspects of the system will be focused on, such as its self-producing mechanisms and organisational closure. An assumption around a systems boundary is required. Assumptions and generalisations need to be justified, since the modelled version needs to adequately represent reality.

An important assumption in this study is the way a social system is defined. Giddens' (1984) definition of a social system will be used, referring to the social practices of actors that are repeated over time and space.

Another key assumption that is made about the Tugela Ferry community being studied, is that for the purposes of the study, it consists of two social systems, namely a Zulu social system and a Christian mission system. In practice, these systems overlap, they are not the only groupings to be found, and clear boundaries are not always apparent. However, in this study, they are selected as focus areas in terms of their social practices, and analytically separated. This assumption is motivated and discussed in Chapter 8 that follows.

To conclude the discussion on the pre-work section of the systems framework: apart from a general background description, including a description of specific elements of further interest, the assumptions and simplifications that go hand in hand with the particular systems approach or theory, need to be declared and motivated. These are given in Chapter 8, before commencing with the systems description in Chapter 9.

7.3 Outline of the social autopoiesis model

This section specifies the system elements and processes that will be focused on, for a conceptual systems description. In defining the elements, the two major inputs are the theories of structuration (Giddens, 1984; Mendelsohn and Gelderblom, 2004) and autopoiesis (Varela et al., 1974; Maturana and Varela, 1987; Luisi, 2003). Both of these theories consider reinforcing cycles of behaviour that produce the identity of a system, and in this case they will both be applied to two social systems, namely the Zulu and mission systems. Giddens' structuration theory is used to describe the autopoietic 'engine' of the system, in particular, the reinforcing, self-producing and boundary creating mechanisms. Giddens' elements of action and social structure are applied as they are provided in the social theory (Giddens, 1984; Mendelsohn and Gelderblom, 2004). In particular, these elements will be used to see what light they can shed on the self-producing nature of the social systems. From the theory of autopoiesis, the elements of organisation and autopoietic structure are considered, as well as aspects such as structural coupling, structural drift, and sustainability, the latter as suggested by Luisi (2003) in his appraisal of autopoiesis.

7.3.1 Giddens' structuration theory as the autopoietic engine

This section starts with a motivation for the use of Giddens' structuration theory as described in Chapter 5, somewhat different to the way it is usually applied in IS literature. Thereafter follows a discussion of the key elements or building blocks of structuration theory that will be included as elements of the systems framework.

7.3.1.1 The use of structuration theory in IS and in this study

Within the IS literature that makes use of social theories, Giddens's structuration theory is the most widely used and perhaps the most influential (Jones et al., 2004; Jones and Karsten, 2008). Avgerou (2009) mentions the use of structuration theory by ICT4D researchers appropriating social theories, notably within the "social embeddedness" research stream in ICT4D, where the local context is viewed as significant. Since technology does not feature

explicitly in structuration theory, and Giddens is not interested in the practical application of his theory (Rose and Scheepers, 2001), the practical application of Giddens' work in IS research remains a topic of discussion and debate (e.g. Jones and Karsten, 2008; Poole, 2009). Among the most popular ways to apply structuration theory in IS, is to use the dimensions of the duality of structure (Giddens, 1984: 29; discussed in Chapter 5), as key variables. The interplay between the information system and its social context is investigated in terms of the structures of signification, domination and legitimation (see Figure 7.1 below). This is also the way in which structuration theory is often applied in ICT4D (e.g. Andersson and Hatakka, 2010; Nyella and Mndeme, 2010). Variations on Giddens' original work where technology is given a more prominent role for the benefit of application in the IS field, include adaptive structuration theory (DeSanctis and Poole, 1994) and Orlikowski's (1992) work on the duality of technology (Jones and Karsten, 2008).

Apart from the more widely known appropriations of Giddens stated above, Jones and Karsten (2008), in their review of 331 IS papers, discuss those that explicitly make use of structuration theory in a variety of other ways of application. They mention papers that focus on particular concepts, such as social and system integration, the knowledgeability of agents, and time-space analysis of social practices. The use of specific structuration concepts in IS research is also discussed by Walham and Han (1991). Jones and Karsten (ibid.) furthermore mention a substantial group of publications that critically engage with structuration theory, focussing for example on perceived shortcomings in the theory or the ways it has been used in IS research. From Jones and Karsten's discussion, it appears that there is no set way in which to use Giddens; in addition, there are many opportunities to extend the existing research base. Among these Jones and Karsten (ibid.) state the opportunity to explore and interpret structuration more thoroughly, the opportunity to give more attention to the social and institutional context within which IS is studied, and the opportunity to study contexts where social actors' agency is constrained.

For the current study, the opportunities identified by Jones and Karsten as stated above will be kept in mind, but are secondary to the study's main research aims. The researcher wishes to make use of Giddens in the manner it has been taught to her during a Sociology majors course in contemporary social theory (Mendelsohn and Gelderblom, 2004), where Giddens was interpreted in the larger context of social theory, rather than in an IS context. This is believed to be important and appropriate for a study that focuses on the social context *per se* in an ICT4D case. In this case, the social context is first described and studied as social systems of

interest, whereafter the influence of ICT on the social systems is studied. This is different from the more commonly studied interplay between ICT and the social context.

The summary of Giddens' structuration theory in Chapter 5 will be used as the theoretical basis for its application in the systems framework. The summary in Chapter 5 is broadly based on Mendelsohn and Gelderblom's (2004) interpretation, supplemented by reading of selected primary literature (Giddens 1979; 1984). Structuration theory concepts are included in the systems framework as separate, but interrelated elements. Further, the application of the dimensions of the duality of structure in the framework differs from its usual application in two key respects. Rather than using the labels of 'signification', 'domination' and 'legitimation', the structural rules and resources underlying them are used as labels. To the researcher, the notion of 'normative rules' is something broader than signified by the term 'legitimation', for example. Also, rather than using the three well known dimensions of the duality of structure, a fourth is added by separating the allocative and authoritative resources that are usually thrown together in the dimension of 'domination'. In the Tugela Ferry case where access to resources is a key concern, this separation assists in highlighting the respective (but interrelated) roles of these resources.

STRUCTURE	signification	domination	legitimation
MODALITY	interpretive schemes	facility	norm
INTERACTION	communication	power	sanction

Figure 7.1: Giddens' dimensions of the duality of structure
(Giddens 1984: 29)

STRUCTURE	interpretive rules (signification)	resources (domination)	normative rules (legitimation)
MODALITY	interpretive schemes (stocks of knowledge)	facility	norm (rights and obligations)
INTERACTION	communication	power	sanction

Figure 7.2: Giddens' dimensions as by Mendelsohn and Gelderblom
(Mendelsohn and Gelderblom 2004: 93)

7.3.1.2 Overview of application of structuration theory

The concepts of the systems framework that are described below are the ones used for *data collection*. Some data collection examples are presented as well. A less elaborate version of the framework has been used for *data analysis*, as presented in Chapter 9. The framework presented below is summarised after its discussion, in Table 7.1 of this chapter.

Firstly, the elements of structuration theory are introduced as system components. The elements of action that will be used here are temporality, knowledgeability and capability, as per Mendelsohn and Gelderblom (2004) and Chapter 5. Whereas the inclusion of temporality here may seem unusual, time cycles are regarded as an important factor underlying agency in Tugela Ferry. Concepts of knowledgeability and capability will not only be considered in the context of mundane social interaction, but also in a practical context. For example, capability is related to the ability to mobilise material resources, which have a wider practical application than just the social.

The elements of social structure are resources (allocative and authoritative) as well as social rules (interpretive and normative). This study recognises that the elements of action and structure are interrelated in the structuration process, as stated in Giddens' duality of structure. At the same time, the "loosening" of the building blocks of action, structure and their underlying elements, for analytical purposes, enables a more detailed analysis and multiple linkages to be made. An important linkage that is made possible when using the structuration concepts as stated, is between the elements of structuration and the elements of autopoiesis. For example, the contribution of knowledgeability and capability to a social system's self-producing organisation can be investigated.

7.3.1.3 Social action

Temporality

Giddens' conception of agency is situated in time. Social action is repetitive within time cycles, whether days, weeks, seasons or generations. Structuration theory recognises the temporal existence of social actors, and the associated routines in which actions are embedded. According to the duality of structure, the daily social routines of actors contribute to long-term institutional practices, which are also the medium of daily routines.

When applied in the case study, the element of temporality considers how time is perceived by the Zulu and mission systems. Time cycles and related rituals that are central to the Zulu identity as well as to the mission's identity, are investigated. (Giddens is concerned with the "flowing" nature of time). Since the Tugela Ferry people are living among the hills, in close contact with the elements and exposed to nature, and since they have a strong social identity with associated time-related rituals, temporal events appear to have a determining influence on their identity. These recurrent and routine practices are perceived to be key aspects of self-producing behaviour in the particular systems.

Knowledgeability

Knowledgeability refers to what social actors know about society and how to act in it. According to Giddens, humans are highly knowledgeable about what to do in social encounters, although much of this knowledge is practical and cannot necessarily be expressed (Giddens, 1984: 22). People make use of interpretive schemes and have commonly understood shorthand for communication, as discussed in Chapter 5. In terms of the duality of structure, knowledgeable agents know and apply rules of structure during social action, and in turn generate those rules. Social rules are absent but made present through the knowledgeability of actors (Mendelsohn and Gelderblom, 2004: 65).

In the case study, the element of knowledgeability has been used to investigate the "stocks of knowledge" (Giddens, 1984: 4; Mendelsohn and Gelderblom, 2004: 64) about social interaction that is held by the people of the Zulu and mission systems, as a requirement of their interaction within those systems. Their ability to socially interface with surrounding systems was also investigated. Social knowledge is implicit: there is a pre-understood common understanding between people sharing this knowledge, enabling them to "read" a situation in its context, even when many things are left unsaid. This kind of knowledge is taken for granted by the people using it and can possibly only be articulated in contrast with a different group or culture's social knowledge. When visiting Tugela Ferry, the implicit presence of a different and unique kind of knowledgeability is striking. In the case of the Zulus in particular, cultural interpreters living in the community were consulted by the researcher to try and gain a basic understanding of this knowledge, in particular the "practical consciousness", or continuous acting out of everyday practical knowledge, and its identity creating nature. An example that has been encountered is the way people in a traditional setting act when another person enters the room. People's gestures, who speaks first and the way people address each other are determined by relative seniority, which is again related to

age and gender. In an IT training context, the course presenter may be oblivious so such social cues and deal with a situation inappropriately. The presenter may then be faced with a response such as lack of participation, not understanding where it originates from.

Capability

Capability considers the ability to intervene (or not) in a course of events, and to the availability of alternative actions, not necessarily consciously considered. The concept of power is related to capability. Giddens mentions two kinds of power: strategic and relational. Strategic power refers to the general ability to intervene, get things done and effect change. Relational power refers to the ability to influence the agency of other people in order to achieve an outcome. The opposite of capability is powerlessness. In terms of the duality of structure, capability refers to the ability to command allocative and authoritative resources, which are in turn produced by exercising power (Giddens, 1984; Mendelsohn and Gelderblom, 2004; Section 5.5.1.3 of this study).

In the Zulu context, one could look at people's means to intervene if a child becomes sick, or a drought affects the crops, or alternative income sources are sought. The researcher's impression of the community is that many of the Zulu people are often at the mercy of their circumstances, and that their ability to intervene is limited. At the mission, the people in its employ are perceived to make an effort, within their means, to enhance the opportunities available to their members, as well as to the Zulu community at large.

7.3.1.4 Social structure

Social structure refers to the "patterning of social relations" (Giddens 1984: 16). It exists as memory traces in the minds of actors, and is made present as it is instantiated in the social actions of actors. Social structure consists of social rules and resources. The use of rules can be inferred from the knowledgeability of agents and the use of resources from their capability, as observed when they act. Rules and resources are interrelated, and are only separated for purposes of analysis, as discussed in Chapter 5.

Rules

Social rules refer to the knowledge of social procedures that we tacitly draw upon during social interaction. These are the stocks of knowledge, as referred to in the section on

knowledgeability above. They inform our knowledgeable actions, and from the regularities in our actions, these rules can only be inferred. Rules are dependent on the context where they are applied. Giddens distinguishes between constitutive and regulative rules, which are different aspects of rules rather than being mutually exclusive (Giddens, 1984: 18-20; Mendelsohn and Gelderblom, 2004: 89; Section 5.5.1.6 of this study).

Constitutive or interpretive rules are used to classify behaviour in a particular situation. They are the sense-making rules, which we use to figure out what an action means. Words, body language and facial expressions are interpreted in the particular context where they are observed. When interacting with a different culture, assistance is needed to interpret this aspect of communication.

Regulative or normative rules are those that specify what should be done in a social situation, or what is acceptable behaviour. In the case study, Zulus are perceived to have regulative rules that are governed by one's place in the social structure, as determined by age, gender and rank. These rules are usually not spoken and are not directly accessible to an outsider. The mission communicates a strong set of value-based rules, making it clear what kind of behaviour is acceptable or not, based on biblical values.

Resources

Resources provide the means for people to perform tasks. Resources are usually distributed unevenly through society. Resources can be mobilised to provide social power to people, while social power can again be used to gain more resources. According to Giddens (Mendelsohn and Gelderblom, 2004), reinforcing or constraining cycles can be observed, where access to allocative and authoritative resources can have a mutually strengthening effect, and enhance people's capability (as an element of action). Capable people are in a position to increase their resources. Conversely, people with few resources have a lower capability which constrains their ability to accumulate resources.

Allocative resources are those that assist in commanding the natural world. It can be any kind of material, technology/equipment or produced goods. Examples are money, ground, livestock, and means of shelter, food storage, transportation, and farming. Lack of access to such resources can constrain or disempower people.

Authoritative resources are those that assist in exercising power over people. Royal lineage or seniority in an organisation could be authoritative resources. In the Zulu community, one's gender, age and lineage, among other, influence your social standing. Diviners have authoritative power, as they are perceived to be in contact with the authority of the ancestors. In the mission, a pastor conveys a message from God, and therefore has authoritative power. According to Giddens, as explained in Mendelsohn and Gelderblom (2004: 93), authoritative resources were the base of power in non-capitalist societies, whereas allocative resources are a more important power base in capitalist societies. The strong authoritative resource base of the Zulu culture may be ascribed to its non-capitalist tradition.

According to Giddens (1984: 262), the means of storing allocative and authoritative resources are important characteristics of a society. Access to information is an authoritative resource, and the ability to store information can enhance this resource. Information collected during this research indicates that the Zulus have a strong oral tradition, possibly with special ranks of people forming the "repository". Mixed levels of literacy mean that people do not have equal access to written stores of information. Providing people of a lower social rank with a means to store and access information during IT training may upset existing implicit power structures.

7.3.1.5 Social practices

Social practices are the tangible embodiment of the structuration process. Giddens refers to the following levels of socially embedded structure (Giddens 1984: 25,164; Section 5.5.2 of this study):

- Social practices: social activities which are regularly repeated by actors;
- Social systems: social practices repeated over time and space, by many actors;
- Institutions: social practices deeply embedded in time and space; and
- Society: a strong cluster of institutions, often going along with a particular locale or type of locale, and a shared social identity.

As can be seen from the above, social practices are the ingredient of social systems, as defined by Giddens. Social practices link the process of structuration, and thus the elements of action and structure, with the notion of a social system.

The two systems of focus in the case study, as systems served, each have a rich set of social practices, many of these found in rituals. Work that has been done to describe the two social systems using the other framework elements of structuration, together with supplementary material on cultural practices, are used to describe the social practices.

Considering the levels of socially embedded structure noted above, the Zulu community as well as the mission has institutionalised practices and to some extent operates at the level of 'society'. The notion of social system as applied to the case study also considers the more deeply embedded social practices.

7.3.2 General autopoiesis elements

Key elements of autopoiesis theory (Varela et al., 1974; Maturana and Varela, 1987; Luisi, 2003) are used in the subsections that follow to describe the two systems investigated, as well as the interaction between them. The elements of autopoiesis have been introduced in Chapter 6. Their application in a social context is not straightforward. For each element, its original definition is presented again below before commencing with a social application, the latter taking into account aspects of Maturana and Varela's (Chapter 6), Giddens' (Chapter 5) and Mingers' (Chapter 6) work, other literature on social autopoiesis (Chapter 6) as well as the practical situation faced with on the case study.

7.3.2.1 Organisation

A system's organisation refers to "the relations between its components that realise the system as a whole" (Varela et al., 1974: 188). It can also be regarded as a system's functional description, by which the system can be distinguished or identified. In a social autopoiesis model using structuration theory, the distinguishing relations of a social system would be its particular processes of structuration. In the systems framework, the processes of structuration are described with reference to the elements of social structure of the system. Thus, the *identifying social structure* of the system can be used to describe its organisation. Practically, we need to keep in mind that neither the processes of structuration nor the social structure is visible to the observer – these are only inferred from action and/or social practices.

As an example of data relating to the element of organisation, the identifying social structure of the mission is its Christian faith and associated biblical values. This value system is observable as it is preached from the pulpit as well as in attempts by its members to practise it. In particular, the officials of the mission have realised that they will win over the Zulu

community by their deeds rather than their words. In this spirit, they have attempted practical interventions in the Zulu community that display a caring value system and that provide practical help, such as an orphan care centre.

7.3.2.2 Structure

It is potentially confusing that structuration theory and autopoiesis theory each has its own definition for the term "structure". The phrase "social structure" will be used when referring to Giddens, to make it clear from the context which term is referred to.

Structure, in the autopoietic context, refers to the observable characteristics of a system, in terms of its components and their relations. It is the particular embodiment of its organisation, since one kind of organisation can be embodied in different structures (Turpin, 2009; Maturana and Varela, 1987: 47; Section 6.2.1 of this study). The observable instantiations in Giddens' social system are social practices. In this study, social practices are associated with a visual richness in their instantiation, and artefacts that symbolise social practices will also be included in the definition of structure.

Examples of artefacts that symbolise social practices are the parts of dead animals which decorate the houses of Zulus who practise ancestral worship, such as horns of a buck that are fixed to the roof of a dwelling. An example of a unique structural element found in another social system in Tugela Ferry, namely the Shembe church, is the manner in which places of worship are demarcated with white stones on the ground. These white stone circles or squares can be seen from afar, and everyone living in the vicinity knows what these stones signify.

7.3.2.3 Organisational closure

An autopoietic system is open from a structural point of view and actively engages with its environment. However, for a system to be considered autopoietic, it needs to be organisationally closed. Organisational closure refers to the means by which a system creates its own boundary, in order to have a functionally autonomous existence. One of the largest debates in social autopoiesis literature is about whether and how organisational closure can be shown for social systems. Whereas a biological system has a clearly identifiable boundary, the same is not true for social systems. The notion of a boundary that appears most feasible in the social domain is a boundary of distinction (see section 6.3.6.1). Even with such a boundary, it is difficult to show organisational closure and many scholars believe it is not possible. However, the literature review on social autopoiesis in Chapter 6 concludes that the principles

of autopoiesis could be applied to a social system without having to claim that the system is autopoietic or organisationally closed.

The above stated conclusion is followed rather than trying to make an argument for the organisational closure of the Zulu and mission systems. In the case study, an investigation is made as to what factors contribute towards the organisational closure of the systems, and what factors work against closure. This forms part of the investigation into reinforcing, identity creating, self producing and sustainability creating mechanisms in the systems at hand, which contributes to the notion of 'development' in ICT4D, and the mechanisms countering sustainability and thus development.

7.3.2.4 Structural drift

Structural drift refers to the changes in structure over time, as part of the mutual adaptation between the system and its environment (which can include other systems). In autopoiesis theory, structural drift assumes the conservation of organisation. However, in a social system the distinction between changes in organisation and structure is less clear. Social structure (being the social system's organisation) and social practices (being the social system's structure) continually influence each other.

For example, a traditional Zulu family who live in a hut made of reeds and mud may upgrade to a brick house. A brick house provides the possibility of alternative living arrangements, since it can have multiple rooms, as opposed to huts that are single roomed structures. A traditional household would consist of multiple huts, including a cooking hut, whereas a brick house can have a kitchen. Modern houses can be electrified. One of the common pieces of electrical equipment observed in a modern Zulu house, is a television. The television is not just an artefact but brings along with it the underlying cultures and value systems of the programmes broadcasted. This may have a structural influence, such as promoting clothing fashions. However, it could also have an influence on organisation if it influences the culture, value systems and associated social practices of the television watchers.

In this study, the term "drift" will hence be used to refer to changes occurring in the social system over time, whether related to their social practices or their social identity.

7.3.2.5 Structural coupling

Structural coupling refers to the recurrent interactions between two or more systems, or between a system and its environment, such that a change initiated by one triggers a structural change in the other, and vice versa. Through a series of non-destructive mutual triggers, they manage to co-exist in a compatible way (Maturana and Varela, 1987: 75; Section 6.2.3 of this study).

When applying this concept in the social domain, it can assist to study the 'horizontal interdependence' and 'vertical complementarity' that form part of Roode et al.'s (2004) notion of human development. Roode et al.'s (ibid.) definition was developed to apply in an ICT4D context, where it is acknowledged that socio-economic development requires a self-reliant social system that has successful interdependence relationships with surrounding systems.

The case study investigates how the mission and Zulu systems co-exist and influence each other. The structural coupling between these two systems and their respective environments are also studied. For example, in the relationship between the mission and the Zulu community, it appears that the mission assists, within their means, to enhance people's capabilities as well as their material resources (medication, food, access to welfare grants), using the language of structuration. In this way, numerous orphans and sick people are dependent on the mission for their physical wellbeing. The mission is dependent on the goodwill and social acceptance of the Zulu community in order to stay and operate as they are. As such, they respect the interpretive rules and knowledgeability of the Zulus, but introduce new normative rules with a biblical value system. The mission benefits from the harmonious relationship, which helps to provide an appropriate setting where they can practise their spiritual calling, and as such act out the interpretive as well as normative rules that guide the mission's members.

For the ICT4D project, knowledge of the structural coupling between the mission and traditional Zulu systems is essential. The ICT4D project team only has access to the mission; the barriers of language, culture and geography prohibit them from direct access to remote rural people. However, the aim of the ICT4D project is to contribute to the socio-economic development of the Zulu community at large and not only to the mission. If the ICT4D project can show that, because of the structural coupling between the mission and Zulu systems, the Zulu community can indirectly benefit from the IT training that they provide to the mission people, they can show that they have achieved their broader aim.

7.3.2.6 Sustainability

According to Luisi (2003: 51), an autopoietic system is one that is self-sustaining, or able to maintain itself. As discussed in section 6.2.10, an autopoietic system is autonomous (Maturana 1981). Autopoiesis implies autonomy as well as sustainability, but not the other way round. Autonomy and sustainability, as related to autopoiesis, are useful concepts to apply to a social system.

The question of sustainability is key in ICT4D. In Chapter 2 it is argued that an ICT intervention that contributes to the sustainability of the social system in which it is introduced, contributes to development. A way is then needed to assess the sustainability of the social system, and how sustainability is influenced. Luisi's (2003) work which links autopoiesis and sustainability indicates that autopoiesis concepts can be used to study sustainability. Self-producing mechanisms that strengthens the system and work towards autopoiesis, will work towards sustainability. Problems with sustainability will indicate that self-producing mechanisms are not effective.

In the case study, the sustainability and related dynamics in the Zulu and mission systems are investigated. Work performed under previous headings, such as the description of the internal system dynamics based on structuration theory, and the study of the systems' structural coupling, will be used to assess the sustainability of the two social systems. Once this is done, the effect of the ICT4D project on the sustainability of both the social systems served will be investigated.

7.3.3 Systems framework: summary and synthesis

A summary of the systems framework is presented in Figure 7.3, while a detailed diagram with all the elements of the framework is given in Table 7.1. Giddens' dimensions of structuration theory are used to seek reinforcing cycles of behaviour that are core to the identity of the systems investigated, and in this manner describe the systems from the inside. The general autopoiesis elements and characteristics of the systems are described when applying the framework to provide, in addition, a description from the outside. The descriptions of the basic autopoiesis elements are used together with the information generated by structuration theory, to assess the autopoietic or self-sustainable character of the two systems, and their interaction with each other and their environment. After describing the Zulu and mission social systems (as systems served) in this manner, the ICT4D project is also described, as the serving system. By considering mutual influences among these systems, it can be assessed whether and how the ICT4D project influences the self-producing mechanisms of the systems served. Such an analysis is used to assess the contribution of the IT literacy training towards the sustainability and socio-economic development of the systems served.

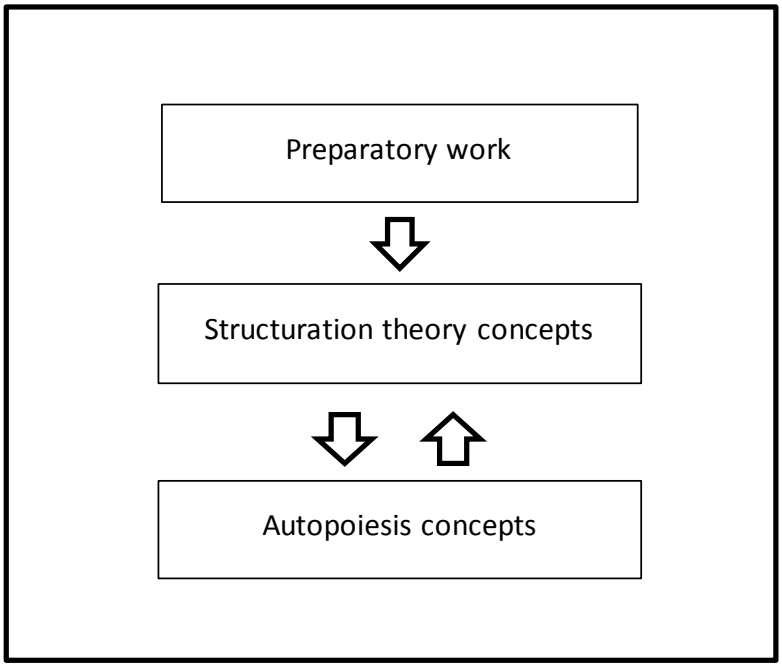

Figure 7.3: Overview of the systems framework

Preparatory work
Background sketch, including a CATWOE description of each system Stating of assumptions and simplifications

Concepts of structuration: description from within the systems				
Giddens' dimension:	Structure of signification	Structure of domination	Structure of domination	Structure of legitimation
Element of structure:	Rules (interpretive)	Resources (allocative)	Resources (authoritative)	Rules (normative)
Element of action:	Knowledgeability (of interpretive rules)	Capability (to apply allocative resources)	Capability (to apply authoritative resources)	Knowledgeability (of normative rules)
For a social system: Rituals (notion of temporality: daily, lifetime and institutional time spans) Social practices				

Concepts from autopoiesis theory: looking at the systems from outside	
Use Giddens to populate:	Organisation Structure Drift Organisational closure Structural coupling
Derived concept:	Sustainability

Table 7.1: Elements of the social systems framework

It is noted again that although the systems framework elements are independently listed, they are all interdependent, and only separated for purposes of analysis. Giddens' dimensions of action and structure are simultaneously part of the processes of structuration. The identity creating structuration processes within the system is part and parcel of its organisation, as it appears under the autopoiesis heading. The information collected under the elements of structuration contributes to the description of the autopoiesis elements. The interdependence

of the framework elements may result in some repetition of information during the analysis exercise, or when repetition is avoided, the descriptions of some system elements appear shorter than other. All in all, the interdependence between elements is believed to strengthen the overall framework.

7.3.4 Use of the framework for data collection and analysis

Research that is performed in a deductive manner, where data is collected and interpreted by means of a theory, requires a set of variables to be stated that will guide data collection and analysis. In this study, the elements of the systems framework presented in Table 7.1 are used as a guide for data collection. This does not mean that system elements are directly presented to interviewees, or that information collection is limited by the theoretical lens only. The system elements described above are academic terms, remote from the life world of people in the Tugela Ferry community, many of whom are illiterate and do not have English as first language. As such, a much richer set of data is collected with the aim of mining it for themes related to the system elements. The process is deductive since the theoretical framework remains at the back of the researcher's mind while asking questions and listening to people talking about their life worlds.

Data collection and analysis is done by broadly applying the principles of hermeneutics (Myers, 2009). According to the concept of the hermeneutic circle, the overall understanding of the situation is constantly reviewed in the light of new data collected, and vice versa. In this study, the research process has been hermeneutic. Research has been done in an iterative manner, where initial data collection has influenced the systems framework as well as subsequent data collection. Interpretation of data has started at the same time as data collection and has influenced further data collection. The elements of the systems framework were established relatively early on in the hermeneutic process, and have remained a reference point guiding data collection and analysis subsequently. However, the understanding of the system elements and their application has been modified with rereading of the theoretical material.

Under the heading of each element of the systems framework presented above, its application to the case study is discussed. Examples are presented to illustrate the use of the elements and guide data analysis. The result of the data analysis to follow is a systems description. The systems description is done at a conceptual rather than detailed level, with the aim of demonstrating the framework as well as assessing its value. Data analysis is done by means of

a continuous hermeneutical interpretation, keeping the systems framework, underlying theory, illustrative examples as well as an initial systems description in mind. The data analysis exercise is described in more detail in Chapter 9.

7.4 Conclusion

A social systems framework has been presented in response to the research question:

- What is an appropriate social systems framework with which to study the impact of an IT intervention in a remote, rural African community?

The framework's main supporting theories are Giddens' structuration theory and the theory of autopoiesis, with inputs from Mingers's work on social autopoiesis. The framework is unique in that the concept of social autopoiesis has not been developed into an operational framework and practically tested in this manner before.

The systems descriptions that follow from the framework will help to assess the self-producing dynamics of the two systems served, and their interdependence on each other and their environment. This creates a means to investigate the impact of the ICT4D project on the two systems, to see whether and how it contributes to the socio-economic development and sustainability of the systems at hand. As such, the elements of the framework build up towards assessing a social system's sustainability, which is a novel way to regard sustainability in an ICT4D context.

In Chapter 5, it has been shown that at conceptual level, the framework meets the stated criteria for a social systems framework, and in particular how its application can assist to meet the research aims of the study. In Chapters 8 and 9 that follow, the framework will be applied empirically when used as an instrument for data analysis on the ICT4D case study. In this way, the framework's practical value can also be assessed.

Chapter 8 Case study background and assumptions: a contextual overview

8.1 Introduction

This chapter presents the preparatory work required by the systems framework, as presented in Chapter 7. It contains the first part of the application of the systems framework to the case study. In doing so, it works towards addressing the following research question:

- How can a systems framework based on social autopoiesis be practically applied in a deeply rural community in a developing country?

Part I of the chapter deals with background and contextual information on the community representing the case study. Part II provides background and contextual information on the ICT4D project, or serving system. In Part III, the assumptions and simplifications that are made during the systems description and analysis are discussed.

In Part I, the description of the context commences with a general demographic overview of the community, using information collected by the researcher from third party sources as well as from community members. Following this, the history and current situation of two social systems of interest, namely the Zulu community and the Tugela Ferry mission, are discussed. These systems are of particular interest as 'systems served' by the ICT4D project in the case study. The studying of the two respective systems' turmoiled and problematic pasts as well as historic successes assists with understanding how they came to be as they are. It also gives one a sense of what may be expected with regard to their futures.

Subsequent to the contextual descriptions, CATWOE descriptions are provided for both the Zulu and mission cultures, following Checkland (1999). These descriptions initiate the thinking towards a systems analysis, since it considers the questions of what the social systems are trying to achieve, who the important role-players are, and so forth.

In Part II, the ICT4D project is described in a similar manner as the two systems served, providing historical and contextual information as well as describing the activities of the project. A CATWOE description is subsequently provided.

In Part III, a number of modelling assumptions and simplifications are discussed. When moving from the real world to the abstract systems world, such simplifications are made to assist with focussing on key concepts and their interactions. There is subjectivity and judgement involved in the process, and the aim of the section is to provide the reader with some rationale as to how and why the choices to represent the investigated systems in a particular way are made.

8.1.1 Information collected

It might be expected that a background description will be done on the strength of a literature survey, whereas empirically collected information will form the basis of the analysis that follows. In this study, such a neat separation of background and empirical data is not possible. In the case of the mission, documented sources of its history and demographic context were either not freely available, or at times extremely subjective. Therefore the literature used is heavily supplemented with information collected from local people with a historical knowledge of the community, and again confirmed with other locals. Such triangulation may not remove subjectivity, but is believed to lead to a richer and more representative background description. The researcher's own field notes and interviews documented during field trips are used to enrich the background study. In the case of the Zulu and broader community description, sources with different origins, such as census data and the municipality's Integrated Development Programme, were used and on occasion confirmed with local experts, for example by confirming education figures with the local office of the Department of Education.

Part I: Background and context of the systems served

8.2 Demographic overview

The demographic overview is done to provide a general context of the social landscape in which the study takes place, before focusing on any particular systems. Census data from the 2001 South African census provides a point of departure. This is appended with information from the Msinga local municipality's Integrated Development Plan (IDP), the latest version as personally presented to the researcher by an official from the Msinga municipality (Respondent1) in July 2010.

The area under discussion falls under a dual leadership system. It is Zulu tribal area, as per the Traditional Leadership and Governance Framework Amendment Act of South Africa (41/2003). As such, it is part of the Zulu kingdom, with a hierarchy of tribal leaders under King Goodwill Zwelithini. The Msinga local municipality, which will be used as a unit of analysis, contains six traditional authority areas, namely Qamu, Mchunu, Bomvu, Ngome, Mabaso and Mthembu (Msinga Municipality, 2010). These areas each have a tribal chief. Tribal chiefs can allocate land, act as judges in tribal courts and make decisions concerning tribal matters. People living in this area are also South African citizens. The Msinga local municipality is an institution of the South African government, who governs on three levels, namely at national, provincial and municipal levels. The municipality has an official way of demarcating the area into wards, and any geographical point maps to a traditional leader's area as well as a municipal ward without the boundaries of the traditional areas and the wards necessarily corresponding. When making decisions concerning service delivery, such as building new roads, the municipality is meant to consult with the traditional leadership. According to informal conversations, this does happen in practice although the authority of the traditional leadership is apparently slowly being eroded.

8.2.1 Demographic data from the 2001 census

The Msinga local municipality is a rural area that includes the three small towns of Tugela Ferry, Pomeroy and Keate's Drift (Msinga Municipality, 2010). Msinga is located in the deep gorges of the Tugela and Buffalo rivers, which geographically isolates the municipal area. There is one tarred road that links the area with neighbouring towns.

Msinga is the unit of analysis for which demographic data is readily available, and the observed similarity between the three towns in Msinga municipality leads to the belief that Msinga data will be representative of Tugela Ferry, the focus of this study. The information that follows is obtained from the Statistics South Africa official web site. The data is from the 2001 census, the most recent that is available. The next official census was scheduled for October 2011 (Statistics South Africa, 2011), and that data is only expected to be made public towards the end of 2012.

The total population of Msinga is reported to be 168026. Of these, 99.8% are black Africans, and 99.2% have Zulu as their home language. 99.9% of the people were born in South Africa. To put this into context, the KwaZulu Natal province (the heartland of the Zulu nation) is reported to have 84.9% black Africans, 80.9% Zulu speaking people and 98.9% residents that

were born in South Africa. In South Africa overall, 23.8% of the almost 45 million people have Zulu as their home language, followed by Xhosa and Afrikaans. The population density in Msinga is given as 60 people per square kilometre, compared to 90 provincially and 30 nationally (the latter figure needs to be seen in the light that South Africa includes a few densely populated megacities, as well as desert and other arid areas that are scarcely populated).

The median age of the Msinga population falls in the 5 to 14 years age category, compared to the provincial and national medians that fall in the 15 to 34 age category. The sex ratio of 58% females is somewhat higher than provincial and national averages. Of the people who are aged 20 and older, 68% have received no schooling at all. Provincially and nationally, the majority of people who are 20 and older have received some secondary schooling or higher. The employment rate is 21.3% of the economically active population, compared to 51.2% for the province and 58.4% nationally.

The median household size of 4 people is comparable with provincial and national averages. Regarding dwelling types, 81% of households live in traditional dwellings, whereas formal housing dominates at provincial and national levels. In Msinga, 83.5% of households use wood as their primary energy source for cooking, and only 4.8% of households use electricity. Provincially and nationally, more than 50% of the respective households use electricity for cooking. The dominant energy source for lighting in Msinga is candles, used by 87.9% of households. Provincially and nationally, electricity dominates as lighting source. Regarding access to water, 58.7% of Msinga households have to fetch water from a river or stream. The remaining households mostly have access to shared boreholes or community water stands. Of provincial and national households, the overwhelming majority have piped water inside their house or yard. Regarding toilet facilities, 70.3% have no toilet facility at all, and 22.7% use pit latrines. Provincially and nationally, flush toilets dominate as toilet facilities. Regarding access to telephones, 71.7% of households in Msinga do have access to a telephone (as of 2001), although the majority do not have their own cell phone or land line. Provincially and nationally, the households with no access to phones form a much smaller minority than in Msinga. Table 8.1 below provides a comparative summary of Msinga municipality's demographic data.

	Msinga	**Provincial**	**National**
Black Africans as % of population	99.8 %	84.9 %	79.0 %
Zulu home language	99.2 %	80.9 %	23.8 %
Born in SA	99.9 %	99.0 %	97.7 %
Population density (people / km²)	60	90	30
Employment rate	21.3 %	51.2 %	58.4 %
Dominant adult literacy rate	Illiterate (68%)	Some Secondary schooling or higher (55.5%)	Some Secondary schooling or higher (59.7%)
Dominant dwelling type	Traditional (80.9%)	Formal (60.7%)	Formal (68.5%)
Dominant energy source for cooking	Wood (83.5%)	Electricity (48.3%)	Electricity (51.4%)
Dominant access to water	River or stream (58.7%)	Piped water in own yard (49.5%)	Piped water in own yard (61.3%)
Dominant toilet facility	None (70.3%)	Flush toilet (38.1%)	Flush toilet (49.1%)
Lighting source	Candles (87.9%)	Electricity (61.4%)	Electricity (69.7%)

Table 8.1: Comparative summary of selected demographic data for Msinga municipality

8.2.2 Reflection on census data

Population wise, the census data show an extremely homogeneous group of people living in Msinga, basically all Zulu-speaking South African natives. The homogeneity is exceptional even in a country where the most spoken home language is Zulu. The median population age is very young, compared to the rest of the country. The level of education among people of 20 years and older is extremely low, with more than two thirds of adults being illiterate. Only about one in five of those people who are economically active, have formal employment. Roughly four in five households live in traditional dwellings, use wood for cooking and candles for lighting. They also have to walk unknown distances to fetch water that is not sanitised for household purposes. The majority of households do not have access to toilets, but they do have access to telephones.

It needs to be noted that the concepts of 'economically active' and subsequently, 'employment rate' might be problematic in a deeply rural, subsistence livelihood context. The official definition of economically active refers to someone of employable age (15-65), who is either employed or actively seeking employment (Statistics South Africa, 2001). Someone of employable age involved in subsistence activities during the day, such as fetching wood and water, and tending to a vegetable or maize patch, is working but not employed in a western context. Such a person may be counted as self-employed, even if he/she cannot make ends meet and would prefer a regular source of income. If the person does not have schooling and/or lives in a remote area, there may be no feasible employment opportunities available. According to Statistics South Africa (2001), census data on employment rates in the subsistence agricultural sector may not be reliable. The implication is that people involved in subsistence activities may be counted as (self)employed while they view themselves as unemployed, and they are not actively seeking employment since there are no employment opportunities. In that case, the underlying employment in Msinga may be even lower than the official employment rate of one in five.

8.2.3 Information from Msinga local municipality

The Msinga local municipality has its own Integrated Development Plan (IDP). Each municipality in the country is meant to have an IDP, according to the Municipal Systems Act of South Africa (32/2000). According to the Msinga web site (Msinga Municipality, 2009), the IDP is meant as a strategic five year plan, "informed by the understanding of the needs of the area and tailor made strategic approaches to be adopted by the municipality", and to be reviewed annually. The demographic data provided in the latest version of the Msinga IDP (Msinga Municipality, 2010) largely confirms census data found at Statistics South Africa (2001). Two different versions of the IDP, Msinga Municipality (2009) and Msinga Municipality (2010), are used in the discussion below, since they differ slightly in focus.

Priority issues identified by the Msinga Municipality (2010) are access to potable water, electrification, improved road infrastructure, addressing the HIV infection rate that is currently over 30%, low levels of economic development and high levels of unemployment.

Some of the education challenges are that most of the schools distributed in the area are in need of maintenance and that there are no tertiary education facilities in Msinga (Msinga Municipality, 2009). There is also difficulty experienced in attracting qualified teachers to this

area with its general lack of resources. According to a source at the Department of Education (Respondent2), only around 60% of teachers in Msinga have the required qualifications.

As mentioned, HIV/AIDS is one of the priority matters of concern of the Msinga Muncipality. Currently, there is one hospital in Msinga, 13 distributed satellite clinics as well as 2 mobile clinics. The clinics provide primary health care. (Personal comment: it is perceived by the researcher that a large part of the task of the hospital and clinics relate to the administering of antiretrovirals and tuberculosis medication). Msinga Municipality (2009) mention a large number of orphans, the number being on the increase. The national Department of Welfare has an office in Tugela Ferry, with four welfare workers whose main task is organising foster care.

Regarding employment in Msinga, a member of the municipality (Respondent1) indicates that there are not enough employment opportunities in Tugela Ferry (the largest of the settlements) since there are no industries present. According to Msinga Municipality (2010), a major hindrance to development is the fact that developers are not able to acquire land inside the tribal area. Other hindrances to developers include lack of existing infrastructure, and low skills and income levels of residents. The largest sources of employment in Msinga are Provincial and National government departments and the informal sector. The informal sector consists of subsistence farming and small or micro enterprises (Msinga Municipality, 2010).

Economic opportunities identified in the IDP include increased commercial agriculture and eco-tourism. Most crop and stock farming is currently done at subsistence levels, but the available ground and water from the Tugela river provide potential for farming on much larger scale. Furthermore, the area is “endowed with beautiful scenery and topography that is suitable for eco-tourism” (Msinga Municipality, 2009) although this potential is currently untapped. The Municipality is currently facilitating the development of a game reserve at the junction of the two largest rivers in the area.

The Msinga Municipality is currently unable to collect any levies from people living in the largest town, Tugela Ferry, due to its location in a tribal area. Changes in legislation are underway, which will allow Tugela Ferry to be proclaimed as a town. According to Msinga Municipality, the envisaged tax income will provide a much needed funding source for ongoing development (Msinga Municipality, 2010).

8.2.4 Reflection on background information

The overall picture painted by the demographic data correlates well with personal observations and impressions. The Msinga local municipality in a sense endorses the census data by using it in their IDP. The demographic description of the previous paragraphs is thus held to be fairly representative of the Msinga, and hence Tugela Ferry, community. The Msinga local Municipality's IDP appears to address the most serious developmental challenges highlighted by the demographic data. When comparing different versions of the IDP, it is encouraging to see an increase in sophistication of analysis and planning, and also to see the latest IDP (Msinga Municipality, 2010) reporting progress on development plans announced in the earlier IDP.

8.2.5 Visual representation: Tugela Ferry

A visual representation of Tugela Ferry, with its town as focus, is provided in Figure 8.1 below. This picture indicates where much of the described action is taking place. However, it is not representative of the area or landscape at large – this is the hub of a deeply rural area consisting mostly of rocky hills that are populated with traditional dwellings.

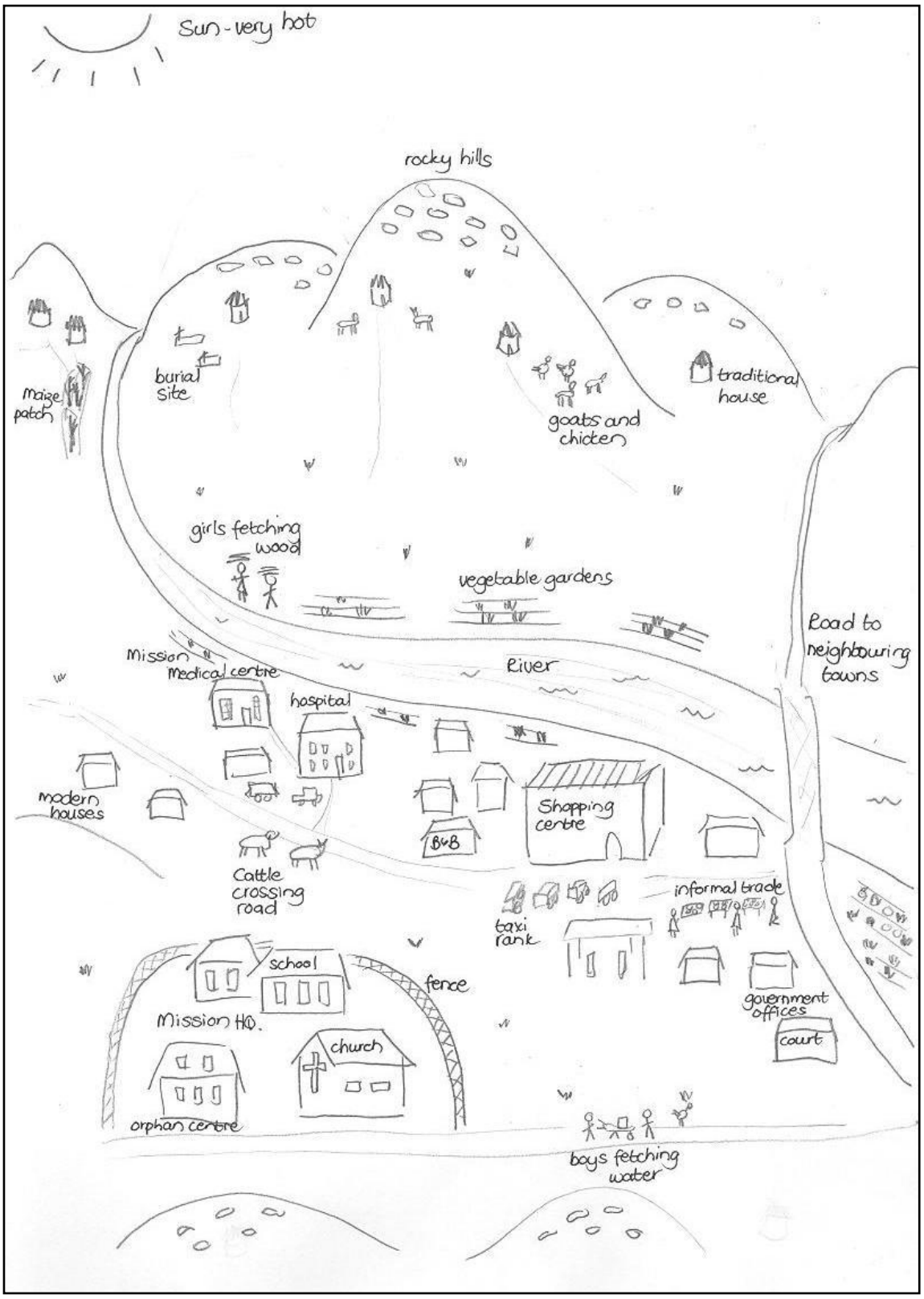

Figure 8.1: Visual representation of Tugela Ferry town

8.3 The Zulu community

The Zulu culture dominates in Tugela Ferry, as is evident from the demographic overview in the previous section. Census data indicates that 99.2% of people in the Msinga Municipality have Zulu as their home language. Msinga is Zulu tribal area and has a traditional leadership system. The geographical remoteness of the area has contributed to the preservation of traditional Zulu culture. The Zulu community is a 'system served' (Checkland and Holwell, 1998) by the ICT4D intervention in the case study. This means that the success of the ICT4D initiative is dependent on its effective engagement with the Zulu community. Moreover, the ICT4D initiative should be able to argue its contribution to the socio-economic development of the Zulu community. Both these criteria require background knowledge on the Zulu community and their socio-economic dynamics. Being a community of interest to the ICT4D project, it is a social system of focus in the case study. The Zulu history and current situation are consequently studied as specified in the pre-work section of the systems framework.

8.3.1 Historical overview

The present-day concerns of the Zulu nation are the result of a turmoiled history that is interwoven with the history of South Africa. The origins and recent influences on the Zulu nation are therefore studied in the South African context. The main source for the Zulu and accompanying South African history is a reference volume edited by Giliomee and Mbenga (2007). This reference presents a comprehensive and recently updated history incorporating the varying viewpoints of 31 co-authors. Giliomee and Mbenga also provide a contextualisation of events that has been found missing from some other sources considered.

The history of the Zulu people is summarised below from the time of the first Bantu arriving from the North, up to their situation in present day South Africa. Considering their history over such a long period assists in understanding their cultural origins as well as their current economic and socio-political situation.

8.3.1.1 Introduction: early farmer settlers

The first African farmers to have migrated down from the North, settled in Southern Africa in the third century (Giliomee and Mbenga, 2007: 22). These farmers, called the Bantu, are to be distinguished from the Khoi and San hunter-gatherers who dwelled in South Africa from a much earlier period. Written history about African farmers is only available after 1500, and archaeology as well as language studies are used to infer details concerning migration

patterns, farming practices and life styles. Farmers used to settle close to water sources with their livestock, namely cattle, sheep, goats and chicken. They planted grains, beans and wild vegetables. In contrast with the hunter-gatherers, African farmers' hunting was limited. Sea trade occurred infrequently between African settlements close to the South East coast, and traders from mainly Indonesia and Madagascar.

Social and cultural practices among the East Bantu grouping, from which the Zulu originated, included a patriarchal system with male lineage and leadership, polygamy, the use of cattle as lobola or bride-gift, and ancestral worship (Giliomee and Mbenga, 2007: 23; Magubane, 1998). They had a distinguishable arrangement of huts and kraals in the household, termed the Central Livestock Pattern. In the centre was the kraal for livestock as well as the gathering area of men. Females were in charge of the sleeping huts, and the multiple wives' huts were built in sequence in an outer circle. (Giliomee and Mbenga, ibid.). When Zulus established a separate culture, the arrangement became known as the umuzi, or extended homestead (Magubane, 1998: 38). The umuzi arrangement was also a social one: "a traditional Zulu umuzi was well regulated by strict etiquette and social discipline" (Magubane, 1998: 43). "A clear distinction was made on the basis of age, sex and rank" (p 45). Each age/gender grouping had duties, for example the young boys had to take the cattle to graze and the girls helped with chores such as fetching water. In the section that follows, the influence of Shaka's reign on the strict social arrangement is discussed.

The current Zulu are descendants of the language grouping known as the Northern Nguni, who initially settled close to the coast but later moved further inland in the direction of the Drakensberg. This move is ascribed to climate changes as well as tribal conflict at the time. Before the time of Shaka, the Northern Nguni lived as scattered, relatively independent farming chiefdoms. Besides sharing a language pattern and culture, there was no unifying element.

8.3.1.2 Shaka's reign and the unification of a Zulu kingdom

By the early 1800s, the area between the Drakensberg and the Indian Ocean was populated by over a hundred independent Nguni clans or chiefdoms. South African History Online (n.d.) is the main source for the piece that follows. Its authors acknowledge that some details of Shaka's history are based on oral sources. Shaka was born ca.1787 from the chief of a small clan, the Zulu. His parent's union was not socially accepted and he was brought up in neighbouring clans, where he made his mark as a promising young warrior. When his father

died in 1816, he went to claim the position of ruler of the Zulu clan. His warrior skills as well as his existing relationships with other clans assisted him in conquering surrounding clans. Clans were conquered either by submission or through serious war and bloodshed. Some clans fled from the region, causing a migration movement with major displacement and clashes elsewhere (part of a disruption termed the Mfecane). Shaka was building a new kingdom. Within this kingdom, a new, military, social system was put in place. Young men (the amabutho) were kept separate according to their age groups, in military regiments. They were taught new rules of combat under strict discipline. Shaka put in place a centralised government of the region, although individual clans could manage themselves locally under the authority of the kingdom.

Shaka's first interaction with white traders arriving in Port Natal was in 1824. He treated them well and allocated them land. He wanted to maintain good relations with the Cape colonial government and was interested in the white man's customs. Shaka was an undisputed and mighty ruler, but also cruel to his own people when they did not obey his wishes, leading to increasing resentment. In 1828, Shaka was assassinated by his half brother Dingane, who succeeded him as Zulu ruler. Shaka's influence on military strategy, social structure as well as the arrangement of huts in the household was significant. Much of what is currently viewed as Zulu culture emanates from the time of Shaka.

8.3.1.3 Colonising of the Zulu kingdom

In 1838, the Voortrekkers arrived in the Natal area with the intent to settle. Some murderous clashes followed between the Boers and the Zulus, led by Dingane (Encyclopædia Britannica, 2007; Giliomee and Mbenga, 2007: 146). Among these were the murder of Boer leader Piet Retief and the battle of Blood River. The clashes led to a civil war between Zulu leaders Dingane and Mpande, the latter allocating the Voortrekkers ground. Soon afterward, in 1843, the British annexed Natal but allowed sovereign reign of the Zulus. Civil war continued among the Zulus, until they settled under the reign of Cetshwayo. In 1879, the British decided to invade Zululand in order to assert increased control and to amalgamate colonial territories. The British lost a major battle at Isandlwana, but persevered using their superior resources and eventually annexed Zululand in 1887. During this period, the British started to take over the traditional Zulu government structure and imposed a hut tax, the latter being problematic in a subsistence livelihood arrangement. The Zulu's communal strength was severely weakened during this time (Giliomee and Mbenga, 2007: 165-168).

The discovery of gold and diamonds in the South African colonies in the late nineteenth century increased the motivation and hence the force with which Britain attempted to control the region, as well as the rest of South Africa, leading to the outbreak of the Anglo-Boer war in 1899-1902 (Giliomee and Mbenga, 2007: 158-164). The Zulus were not directly involved, although many skirmishes took place in Natal. Other results of gold and diamond mining were urbanisation and industrialisation, with a need for labour in the mining towns. Labourers were solicited from the now colonised black territories, causing a pattern of migration labour that became a social institution. Black men (including Zulus, many of whom could not afford the hut tax otherwise) travelled long distances to the towns to work and earn money, leaving their families behind and only visiting them a few times a year. Migrant labour had a disruptive effect on traditional family roles and structure. The women who stayed behind in those times were hard working but had no authority, and yet had to be accountable for all household and family matters (Giliomee and Mbenga, 2007: 206).

8.3.1.4 The twentieth century

After the Anglo Boer war, which ended in 1902, South Africa continued to be ruled by a white minority, the power struggle between Brit and Boer continuing over the decades, roughly as an English – Afrikaner divide (Giliomee and Mbenga, 2007: 186 onwards). The black majority's land ownership was confined to native reserves for the various tribes, amounting to 8% (later 13%) of the ground of the Union of South Africa that was proclaimed in 1910. Although many blacks were working in the cities, their stay in urban areas was regarded and managed as temporary. Racial apartheid was in place for most of the twentieth century, although it was more strongly enforced from the 1950s until the 1980s.

During the 1950s, the homeland system, also known as "grand" apartheid, was institutionalised. The Zulu homeland was hosted in the Natal province. On the map shown in Figure 8.2 (Giliomee and Mbenga, 2007: 324) it appears as a fragmented area, its fertile edges eaten away in the nineteenth century by white settlers. The area was relatively densely populated. Zulus were allowed their own traditional leadership structure, although tribal chiefs had to report to the South African government. Prior to 1953, Zulus had the benefit of independent mission education. Thereafter, it was taken over by government with little concern for the local context, leaving homeland education worse off than before. Little or no industrial development ever took place in the area, there was no mineral wealth, and the rocky hills and mountains did not make for fertile farmland. The majority of economically active males lived and worked away from home. In contrast to the economically booming urban and

industrial areas in the country, the homelands with their subsistence livelihoods stagnated or became worse off. In the height of the struggle period (1970s to early 1990s) tribal faction fights increased, further weakening Zulu strength.

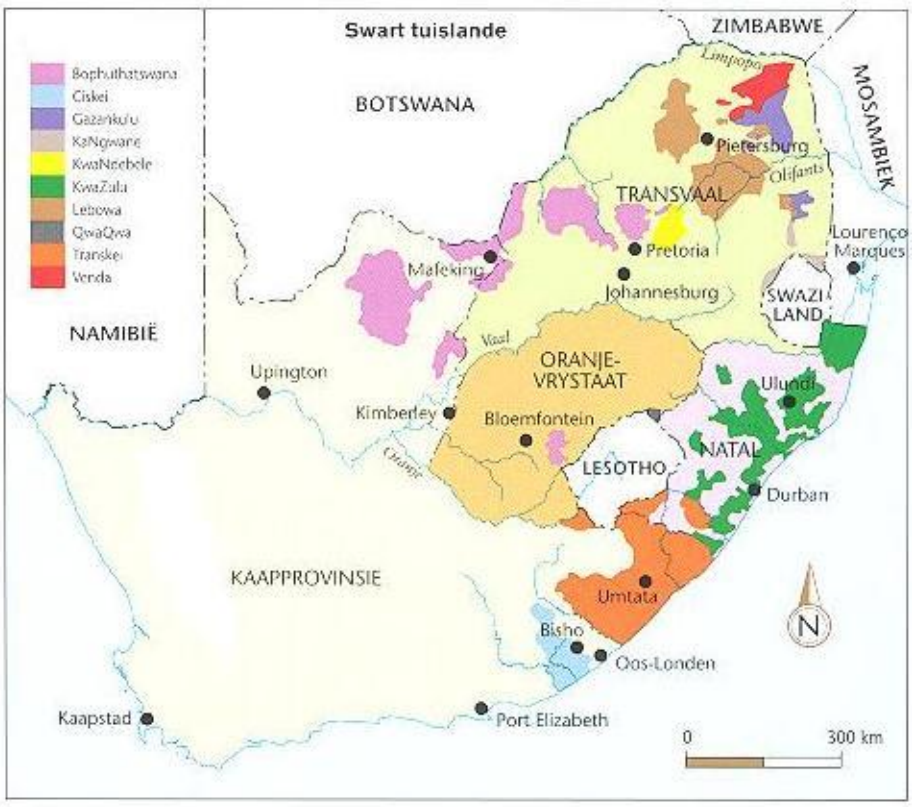

Figure 8.2: Map of South Africa's homelands in the 1950s
(Giliomee and Mbenga, 2007: 324)

The new government of 1994 acknowledged the Zulu tribal land ownership and accompanying traditional leadership system, although the Zulu king has a symbolic rather than executive role (Magubane, 1998: 37). At the same time, the government is investing in infrastructure, health, education and administration of towns in these areas. During the 1990s, social welfare grants were instituted for the elderly, disabled and children of needy parents. The latter helped to soften the socio-economic blow of the impact of HIV/AIDS, as well as the decreased employment opportunities for Zulu men because of a downturn in mining activity and smaller need for manual labourers in the cities.

8.3.1.5 Current situation

The historical situation of the Zulus, including the people from the Msinga district, provides a backdrop against which to explain the current demographic situation in Msinga, as discussed in a previous section of this chapter.

The rural Zulu livelihood saw little external social intervention during the homeland times, and still receives limited social influence from outside while land can only be owned by the Traditional Authority's Ingonyama Trust (Msinga Municipality, 2010), on behalf of the Zulus. These isolating factors have led to the relative preservation of Zulu tradition and culture. The overall lack of transport and communication infrastructure assists to retain the status quo.

What has remained in tribal areas of Zulu culture? The East Bantu social practices of a patriarchal system, polygamy, the use of cattle as lobola or bride-gift and ancestral worship are still traditional Zulu practices. The amabutho age grouping system is an example of Shaka's influence that can still be observed, socially rather than in a military context. There is some clan association, visible as surname families: particular groupings of surnames go together and is thus used to socially place a person, although in a familial relation rather than class context. Further details of current social organisation will be dealt with when the Zulu social system is analysed in a following chapter, by means of the devised systems framework.

8.3.2 Discussion: Zulu community

Despite the fast changing international and national environment and existing social influences, the Zulus remain a homogeneous group who manage to maintain their social practices and culture – probably due to their geographical isolation, limited mobility and poverty, which limits options and general access to information. On political and economic fronts, things are problematic. Politically, the tribal leadership system is slowly being eroded. Tribal leaders have social standing, but the development budgets are controlled by the South African government, members of whom may be quite distanced from, and hence unsympathetic towards tribal social structures. As such, government institutions do not necessarily liaise with traditional structures when making decisions that will affect the Zulu community. At the same time, the current land ownership system that prohibits non Zulus from owning property in the tribal area appears to be a structural barrier to economic development, as implied in the Msinga municipality's IDP (Msinga Municipality, 2009). Economically speaking, the Zulu community in Msinga is in dire straits. The historic mode of

subsistence farming has, since the late nineteenth century, not been sustainable within the geographic and other limitations that were imposed by colonial and later apartheid governments. In addition, the traditional, rural livelihood setup is not geared towards generating money, a necessary condition for interaction with the containing western capitalist environment. Furthermore, the proportion of the population who are economically active is being reduced because of HIV/AIDS. The number of ill people and orphans are placing economic pressure on a community who can barely afford it. The population overall is increasingly dependent on the social grant system.

8.4 The Tugela Ferry mission

The Tugela Ferry mission is the second social system of significance to the ICT4D project. The ICT4D project has been planned in cooperation with the mission, the latter who identified a need for their various employees and care workers to receive computer training. Almost all of the people who have attended computer training (including but not limited to mission workers) are Zulu speaking. The ICT4D team required cultural facilitation when engaging with Zulu trainees and a few key individuals at the mission assisted with the facilitation. The mission is accordingly not only a 'system served', but also an entry point for the ICT4D team into the larger system served, namely the Zulu community, who are also the ultimate clients of the mission. The mission, of whom the majority of members are Zulu speaking, is studied as a separate social system, because of their distinguishing set of cultural practices. Figure 8.3 indicates how the two communities overlap, compared with the way they are studied as social systems. The choice of social systems is further discussed and motivated under the section dealing with assumptions and generalisations below.

The historical overview of the mission starts with a general overview of mission life in KwaZulu Natal during the nineteenth century, when missions in this area were established, shaped and most active. From here, the focus moves to the particular German mission movement that formed the foundation of the Tugela Ferry mission, and the revivals, turmoil, changes and recent influences that have evolved the mission to where it is today. The historical overview is followed by a summary of current mission activities at Tugela Ferry, as well as a reflection on the status quo.

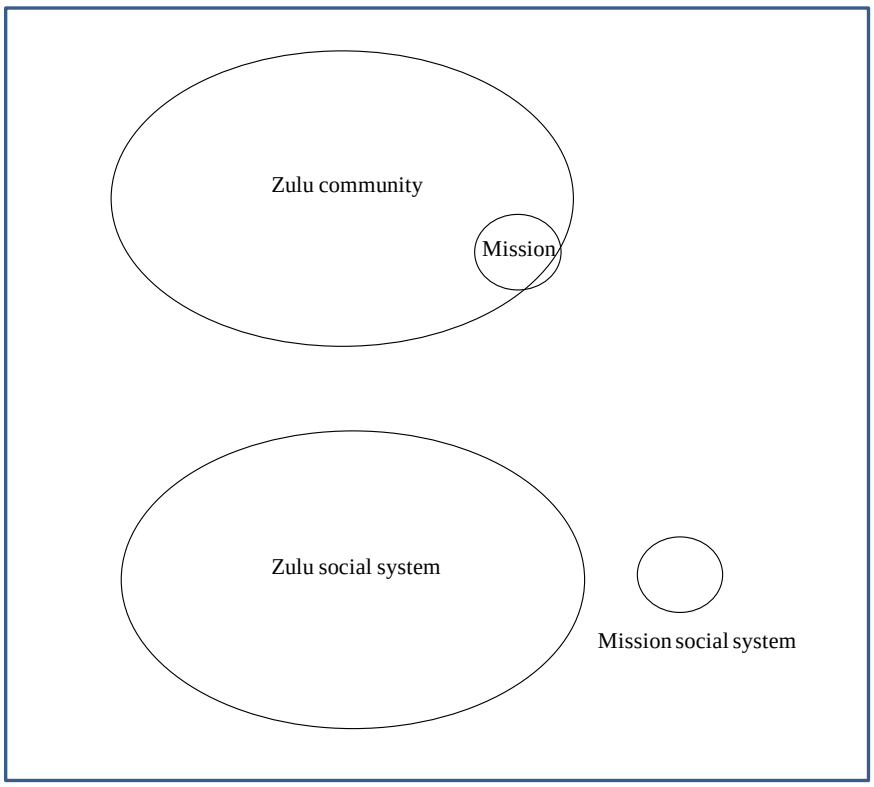

Figure 8.3: The Zulu and mission social systems

8.4.1 Historical overview

8.4.1.1 Christian missions in South Africa

During the nineteenth century, numerous Christian missions were established in Southern Africa, in particular in 'native areas' such as Zululand. The most prominent missionary presences in the Natal vicinity were Presbyterian and Congregationalist Americans from New England, Lutheran Germans from Hermannsburg, Anglicans and Methodists from England, and a Catholic grouping from France (Etherington, 1977). The different mission groupings came with very diverse approaches and mindsets, but "African needs and colonial government so shaped mission communities that after fifty years of evangelisation there were few discernible differences in the operations of the various missionary societies" (Etherington, 1977: 35). For example, the security of the preachers as well as their converts necessitated the formation of residential mission stations. A further commonality observed among the missions was the motivation of northern Nguni to join a mission station: an analysis by Etherington (ibid.) of archival records indicates that only 12% of converts had a religious motivation; the remainder came for reasons such as seeking employment, seeking refuge or a place to stay. Etherington argues that the differentiation between life within and

outside mission stations grew so large that missionaries and their converts became, to an extent, socially isolated from the larger community. This became a barrier to the spreading and diffusion of Christianity among the locals.

One real distinction between missionaries was between those from England and the non-English. The Methodists and Anglicans from England tended to cooperate with the British colonial government. In return for furthering colonial aims and acting as "field officers" for the colonial administration, they received special favours for themselves and their converts. On the other hand, most non-British missions, such as the Germans, acted as agents to promote Zulu independence (Etherington, 1977: 36).

Towards the end of the nineteenth century, there were only a few thousand northern Nguni converts to show among the missions in total, despite all their efforts (Etherington, 1977: 35). The real contribution of missionaries appears to have been not so much the conversion of locals, but rather the establishment and transfer of farming skills, the setting up of mission schools and the use of Western medication and health principles (Giliomee and Mbenga, 2007: 99). This may contradict Etherington's claim of the social isolation of the mission stations, except if the mission people lived separately but indeed laboured among the local people.

8.4.1.2 European origins of the Tugela Ferry mission

With this backdrop to mission origins and influences in KwaZulu Natal, the focus moves to the origins of the Tugela Ferry mission, which can be traced back to a spiritual revival in northern Germany in the 1840s (Kitshoff and Basson, 1985). The evangelical Lutheran church in Hermannsburg, where the revival was experienced, set up a substantial mission initiative. Among others, a ship was built to transport willing missionaries to Africa. During its first voyage in 1853, the ship headed for East Africa, but the eight missionaries on board ended up in Natal, South Africa, where they received a friendly welcome from an existing, small, German community. The group of missionaries settled in the area currently known as the KwaZulu Natal midlands. The work of the missionary initiative in Germany continued and expanded in this region. By the end of the nineteenth century, there were 20 mission stations, 33 satellite stations and 80 preaching stations where the Germans worked among the Zulus (Kitshoff and Basson, 1985: 4). The German community expanded as more Germans arrived to set up farms in the vicinity of the missions, often supporting the mission work. These Germans usually attended and were influenced by the same Lutheran mission church as the

one operating amongst the Zulus. The German community associated with the mission was known for what Greeff (2003) calls their "pragmatism", meaning that they were highly capable in the practical execution of their endeavours. Not only did they send farmers along with the missionaries, they also sent volunteering females to be companions and brides to the missionaries and farmers. The farmers appeared to be quite successful, skilled in the craftsmanship required for the various farming activities, skilled in managing a business, and with a strong work ethic. As such, these communities thrived and the missionaries had a strong support basis.

8.4.1.3 Local roots

During the 1960s, another spiritual revival was experienced locally in KwaZulu Natal, led by a German missionary born from South African farmer settlers. As part of the revival, a new mission station was set up on the border between South African and Zulu homeland ground, so as to make the location equally accessible to white people and Zulus from the tribal area, since the Zulus' movement was restricted outside the apartheid Zulu homeland and the white people's movement restricted within the homeland (Greeff, 2003). The congregation for this new mission grew quickly in what appeared to be a strong revival (Kitshoff and Basson, 1985). The mission soon set up various education institutions, such as a boarding school, teacher education college and adult education centre. It also launched several business initiatives, such as a commercial dairy. By Greeff's (2003: 22) account, the mission's initiatives were examples of successful German pragmatism. By the early 1990s, the mission consisted of about 250 full time workers, including volunteers. Their congregation and supporters were estimated at 40000, with satellite branches as far as Europe and Australia. The Tugela Ferry mission, which is the focus of this study, originated as a satellite branch. During the later 1990s, the mother mission went through a period where it was hurt by internal politics and lost individual members as well as some of the satellite branches collectively (Greeff, 2003). The mother mission still operates today and appears to be a spiritual retreat for people who want to withdraw from the secular world.

A notable point about the mother mission and its satellites was that in the height of apartheid times in South Africa, no apartheid was practised here. The mission "…was a rather strange place for we had very little or no apartheid at all" (Greeff, n.d.) The mission was stated to have good relations with the Zulu community, even through times when the KwaZulu Natal province was troubled with political violence among Zulu factions, a situation related to the problematic South African political situation of the late 1980s. The predominantly German

speaking, white people and the Zulu speaking, black Africans at the mission formed an integrated community up to the top management of the mission. The long term benefit of this was that in later years, the relationship between the mission and the surrounding Zulu community did not suffer from inter-racial baggage, as will be referred to again later.

8.4.1.4 Independence

The current Tugela Ferry mission started in the 1960s as a satellite branch of the above mentioned mission. The church building at Tugela Ferry was erected in 1994. It operated as a satellite branch until 2000, when they broke away from the mother mission to become an independent ministry.

The Tugela Ferry mission still holds strong ties with the German mission movement in Europe, although there are currently no Germans who are prominent or in key positions in the Tugela Ferry church, apart from a few volunteer workers from Germany. The church appears to be democratically run by its Zulu leadership, assisted by a handful of Afrikaans-speaking South Africans. Sunday church services are attended by around 600 people at the main church building, plus smaller numbers of people at the 6 satellite branches that are distributed through the rural area (Respondent3, verified by Respondent4).

Soon after they became independent, a Bible School was established at Tugela Ferry (Respondent5). The aim of this school was to educate the congregation in the biblical principles that were needed to guide their daily living and decision-making. The Bible School addressed a need that was identified in the newly independent mission, namely for people to engage with and interpret the values of the Bible themselves, something they were not used to doing. The researcher personally experienced this culture of interpreting the Bible into broader principles. At a prayer meeting attended in July 2010, the pastor discussed the issue of whether women should only wear dresses and skirts. No rules were laid down, but a number of scripture-based and other normative arguments were presented to persuade all members, female, male and youth, to dress conservatively and be mindful of what they communicate with their clothes in the particular (Zulu) culture.

8.4.2 Current activities

The Tugela Ferry mission may be relatively small in numbers, but their influence is widely felt in the region (Respondent2), in particular through mission associated institutions. Amongst these are the mission school, a medical and social services centre and an orphan care

centre. These institutions will be discussed below. Although this description forms part of a background section, most of the information that follows was collected in the field, as it was not readily available in written format.

8.4.2.1 The mission school

The mission school was established to provide bible-based as well as quality education to the children of the congregation. Information from someone involved in the school since its inception in the early 1990s (Respondent5), indicates that the first grounding principle of the school is a normative one. The biblical principles and way of living taught at the mission differ so vastly from the traditional Zulu lifestyle that separating the children from their surroundings during school time makes it easier to reinforce the Christian value system.

Another grounding principle is quality education. The school currently hosts just over 100 children, from preschool to grade 12. They have maintained a 100% matric (final year) pass rate every year since 2001, the first year that they had a matric group. In comparison, the KwaZulu Natal provincial pass rate at the end of 2009 was 61.1% (Department of Basic Education, 2010). The school receives regular awards for outstanding achievement, having the best results in the municipal district. As evidence, the headmistress has a table in her office filled with trophies and awards received by the school. The majority of its school leavers continue their studies at university, an exceptional achievement for a rural school in a disadvantaged area. Grade 11 learners are annually taken on a university tour, visiting a selection of top South African universities. During these trips, they receive career guidance, have the opportunity to visit academic departments of their interest and receive information about application procedures and study funds. Knowledge of funding mechanisms, such as bursaries and loans, is especially important, since these students' families do not have the financial means to support them at university. For the majority of learners, this is their first trip outside their own province, and signifies the bridging of an immense gap between their isolated rural livelihood and exposure to internationally recognised, further education opportunities. Compared with the general demographic situation provided above regarding education in the district, it is clear that the mission school is an outlier with respect to its activities and achievements. Educators at the school receive a small salary compared to what qualified teachers receive at neighbouring government schools, and the success of the learners is an indication of teacher motivation that is not monetary.

From the above, it is clear that the school's aim of quality education is achieved. The first grounding principle, the provision of a normative value system, follows from empirically collected information that will be discussed further in the systems analysis section.

8.4.2.2 Medical and social services centre

The health-related arm of the mission focuses on the medical treatment and continued care-taking of AIDS and Tuberculosis (TB) patients, volunteer nursing and social welfare work in the broader community. Their philosophy is one of holistic care-giving. Successful administering of antiretrovirals and TB medication requires a strict adherence to medication schedules, as well as healthy dietary and lifestyle practices, and these are all promoted. The hospice facility hosts AIDS and TB patients who are too weak to survive on their own, and whom the neighbouring state hospital does not have resources to help any further. These patients receive specialised medical treatment, and 80% of them are reported to leave the hospice able to continue with their lives, provided that they follow a strict regime of frequent medication, regular meals, basic hygiene and well ventilated housing (Respondent5). Home-based care is provided, mostly by volunteer nursing assistants from the community, who visit these patients regularly to ensure they follow the required practises.

The centre also has a social welfare worker who visits families reported to be particularly needy, where for example the parents are not mentally capable of raising their children without assistance. The involvement of the social worker is wide ranging. If, for example, a poor family qualifies for a child grant from the Department of Social Welfare, the social worker will first assist with the registering of the children's births at the Department of Home Affairs, since such children typically do not have birth certificates. Birth dates are estimated in consultation with the illiterate parents. The birth certificates are used to apply for child grants, intended to help poor parents pay for their children's living expenses. They are then in a better position to send their children to school. Again, the social worker needs to interact with the local school to ensure that the children start attending school regularly.

The government's Department of Social Welfare also has an office in the district, but the enormous need in the community means that their reach is limited to only a small portion of people needing it.

Whereas the mission school focuses on the congregation members' children as their client base, the medical and social services centre is open to assist any member of the community.

8.4.2.3 Orphan care centre

The orphan care centre's focus is on the large number of orphans in the community, resulting from the toll of AIDS on the parents of young children. The person heading up the centre (Respondent5) is proud to state that there are no "street children" in the town of Tugela Ferry. Extensive care is taken to ensure that every orphan in the vicinity is placed with family or in foster care. In order to reduce the burden on impoverished families taking in additional children, a feeding scheme was introduced. The scheme delivers food parcels on a monthly basis, currently to around 600 families caring for orphans. Since a number of the orphans are on antiretroviral medication, it also helps to ensure that they receive the regular meals required by the medication programme.

Some orphans cannot, for various reasons, be placed and a live-in care centre has been established for them. The care centre hosts about 15 children at a time. Another problem identified in the community is that of child-headed households. The care-giving burden on older children often means that they do not have the freedom to attend school and give attention to their studies at home. The orphan centre is in the process of establishing a number of geographically distributed day care centres to look after the younger siblings while the older ones attend school. School going siblings will be provided with homework facilities as well as a meal in the afternoons.

As with the medical and social services centre, the orphan care centre assists with orphan related matters in the community at large.

8.4.3 Reflection: mission community

The mission has an interesting history of living alongside the Zulus. From the original German mission, it has inherited high skills levels, a strong work ethic, and a strict value system. The current mission has a strong service motive, realising that they show themselves through their sustained deeds rather than what they say (Respondent3). In conversations with people from outside the mission (Respondent2), it is clear that the mission has made a name for itself through the sustained and well-organised care giving functions of its institutions, within the wider community.

Their value system is uncompromising, and provides a clearly defined alternative to the ancestral belief system and the aspects of traditional Zulu practices that the mission views as

incompatible with biblical belief. However, there is a deep respect for Zulus and their social practices overall. The mission provides a haven for members who have committed themselves to a different lifestyle, as well as for local and international volunteer workers who frequent the mission and in this way create meaning in their own lives.

Similarities with descriptions of historical missions of the nineteenth century can be observed. Of the Zulu population of nearly 200 000 in the Msinga local municipality, only a few thousand are members of the Tugela Ferry mission; thus, the number of converts remain low. The residential mission station is fenced off with a security guard, and the mission school inside is evidence of a deliberate attempt to separate the congregation children from the general community so that the radically different value system of the mission can be entrenched there. Like the missions in the nineteenth century, the real influence of the Tugela Ferry mission is not so much in the number of Zulu converts, but rather in their education, health care and outreach programmes.

8.5 Rich picture of current situation

Checkland (1999) suggests the drawing of a rich picture as a means to summarise a situation before proceeding to analyse it. Figure 8.4 below presents a rich picture representation of the communities studied in Msinga. It attempts to convey something of the overall demographic context, as well as the traditional Zulu and mission communities. The drawing on the traditional hut presents the situation of the 80% sector of the community that is very poor, as indicated by the census data as well as personal observation by the researcher. The part in the door of the hut represents the more affluent 20% of the community. The mission church and buildings are located in the same geographical area as the more affluent sector of the community. The picture is not comprehensive – it is a concise summary of the researcher's impression. Checkland (1999: 165) advocates for developing "the richest picture possible" as the first step in expressing a problem situation. In this study, the verbal background description of the community presented in this chapter aims to contribute to a rich picture. While the demographical overview is done for the entire community, the background studies of the Zulu and mission communities are done for two pre-selected social systems of interest, and as such are rich pictures only for those two systems.

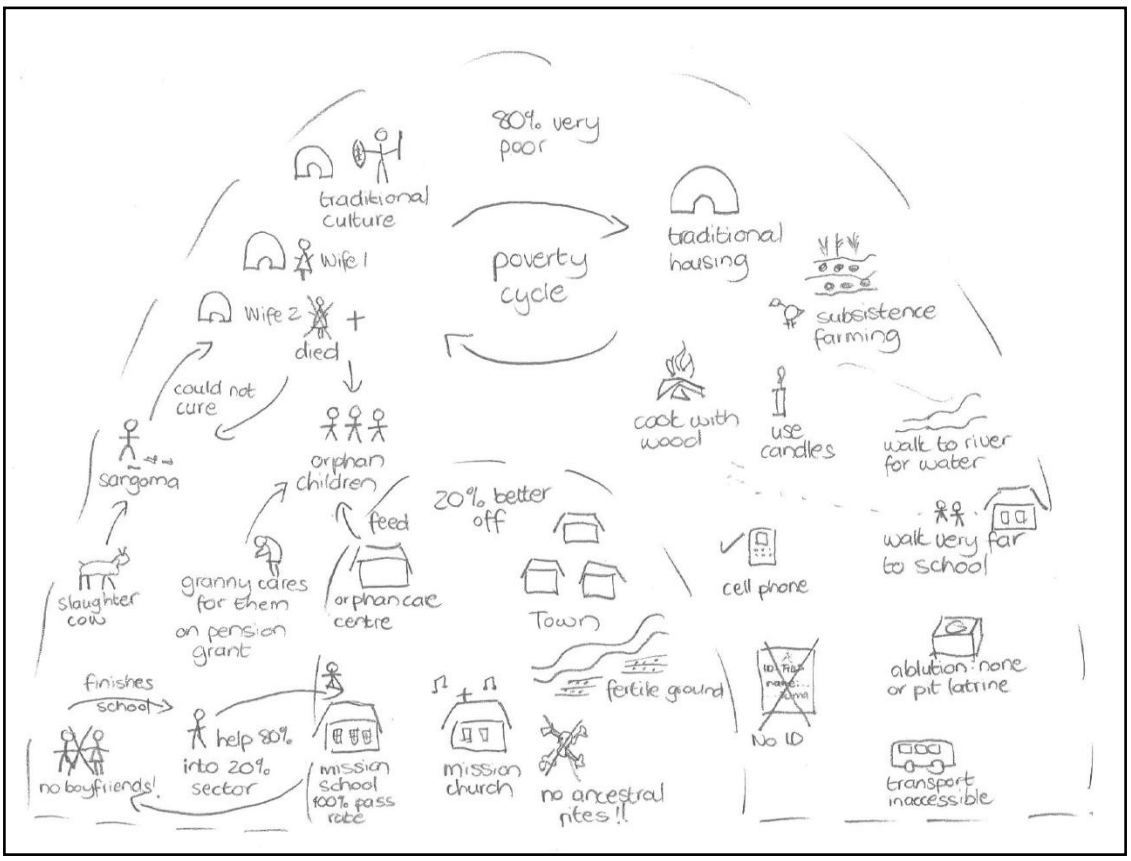

Figure 8.4: Rich picture of Zulu and mission communities in Msinga

8.6 CATWOE descriptions

In Checkland's Soft Systems Methodology (SSM), a general summary of a problem situation is followed by the selection of a number of possible views on the situation, each of which is expanded into a "root definition" (Checkland 1999: 223). This root definition is summarised by the mnemonic CATWOE, as explained in Section 4.5.1, in the overview of SSM. The root definition is an in-between step, following the problem summary and informing a systems modelling exercise. It is informed by the general background description, and thus could be regarded as part of the problem formulation, as per Daellenbach and McNickle (2005: 176). However, it already requires some degree of analysis. For example, it forces one to surface assumptions about what is required by the system (Environmental constraints) and to categorise role-players according to their influence or association, as Owners, Customers or Actors. "Asking these questions, based directly on the CATWOE elements, itself opens up the analysis…" (Checkland 1999: 226)

The CATWOE description is therefore seen as a useful step following a background summary and as an aid to define a system of focus, before proceeding to analyse or model it. Since the two selected systems of focus are the Zulu and mission social systems, a CATWOE description will be provided for the communities associated with each. As is the case with all system related descriptions (see following section on Assumptions), these are to some extent simplified or "ideal type" descriptions, but attempting to reflect reality. Please refer to section 4.5.1.2 for an explanation of the CATWOE terms.

8.6.1 CATWOE description of Zulu community

Customers: Zulus residing in the area (>99% of residents)

Actors: Zulu residents within local municipality
Local tribal chief, plus his group of elders
Government (all levels) that interact with Zulu community
Prominent businesses, as employers and influential actors

Transformation: Short term: survival, in the face of poverty, AIDS etc
Enact and maintain Zulu identity and culture
Ensure continuing future of Zulu tribe, and the furthering of tribal interests
Adapt to changing circumstances

World view: Traditional Zulu collectivist culture, social norms and religious views
Small western capitalist influence

Owners: Zulu traditional leader structure: king, tribal chiefs, indoenas
Government, who can override traditional structure

Environmental constraints:
Authority of tribal leadership system
Increasing influence of government, with developmental rather than traditional interests
Livelihood constraints (poverty, lack of marketable skills, HIV/AIDS, TB, orphans) threatening traditional subsistence livelihood

8.6.2 CATWOE description of mission community

Customers: Members of congregation
Broadly, all people in the area where the mission operates

Actors: Head pastor, who is the leader of the mission church and also an influential businessman
Other pastors
Leaders of institutions e.g. orphan care centre, school, medical centre
All active members, assisting with Transformation
Donors and benefactors

Transformation: Converting people to Christianity
Spiritual, emotional and physical care giving
Promoting mission value system

World view: Converting people by means of their deeds and lived example
Particular version of Christianity preached by mission church
Strong practice based value system associated with the above

Owners: Head pastor, in terms of spiritual, individual and financial influence
Church leadership: group of pastors and elders

Environmental constraints (assumptions):
Harmonious relationship with Zulu community at large
Blessing of tribal chief, required for continued activities
Availability of volunteers and people receiving a calling to work at mission
Funding or donations to sustain projects

Herewith the background and contextual description of the social community of Tugela Ferry at large, as well as the two social systems served, are concluded. In Part II of Chapter 8 that follows, a similar contextual description is done for the serving system, which is the ICT4D project.

Part II: The serving system

8.7 Contextual background on the ICT4D project

8.7.1 Introduction

In this case study, the 'serving system' is a project team from the Department of Informatics, University of Pretoria. As with the 'systems served', a short historical context is provided. Following this, the current ICT4D project is described. Two CATWOE descriptions are provided, one for the short-term training initiative by the 'serving system', and another for the longer-term initiative of assisting with the establishment of a local training centre.

8.7.2 Historical context

The Department of Informatics at the University of Pretoria (UP) has a historical profile of interest and involvement in ICT4D. One of their key initiatives in this regard has been a partnership with the Siyabuswa Educational Improvement and Development Trust (SEIDET). SEIDET was founded in 1992 in a rural area about 130 km North East of Pretoria, in the Mpumalanga province (Phahlamohlaka and Friend, 2004). SEIDET was established to provide supplementary mathematics and science education to historically disadvantaged high school learners. SEIDET is a community initiative and run by volunteers, although a number of non-local stakeholders have been enrolled as contributing partners. One of these partners has been the Informatics Department at UP. The Informatics Department assisted with the setting up of a computer centre at Siyabuswa in 1998, and with providing IT literacy training. The Department has in turn benefitted from a number of students who were able to complete their honours, Masters and PhD research as part of joint projects with SEIDET. Many of the current faculty members of the Informatics Department have been involved with SEIDET in some way or another. Current involvement is low, but the SEIDET trust itself is still active and remains a benchmark example of a locally initiated, successful socio-economic development initiative.

Other ICT4D research at the Informatics Department includes Health Information Systems (e.g. Byrne and Sahay, 2007), e-government (e.g. Twinomurinzi and Ghartey-Tagoe, 2011) and ICT in education research (e.g. Fourie and Krauss, 2011). A new ICT4D development is the national e-skills institute that the Informatics Department is setting up on behalf of the

government's Department of Communication. Of the past and current ICT4D initiatives of the Informatics Department, SEIDET remains the initiative that has seen the largest number of research projects and associated publications. Research outputs related to SEIDET are estimated at 20 (including De Villiers and Scheepers, 2000; Phahlamohlaka and Lotriet, 2002; Phahlamohlaka and Friend, 2004; Phahlamohlaka et al., 2008).

The Tugela Ferry project to be introduced below is, apart from SEIDET, the Informatics Department's only other multi-year ICT4D partnership that has a reciprocal relationship and multiple research projects in progress. However, the earlier SEIDET experience never directly affected the establishment of the ICT4D project at Tugela Ferry. The Tugela Ferry project was initiated shortly after a new lecturer with historical ties at Tugela Ferry joined the faculty of the Informatics Department in 2008. The lecturer, Kirstin Krauss, had close personal ties with the mission staff at Tugela Ferry and was familiar with the settlement and their socio-economic challenges. Krauss became aware of the ICT4D research at UP, and invited a representative from Tugela Ferry to present an overview of the mission's work to the UP faculty. The visit took place in August 2008. The representative included as part of her talk the ICT training and infrastructural needs of the mission. Some of the UP faculty became enthusiastic about possible involvement in Tugela Ferry. The UP Head of Department approved a reconnaissance visit to Tugela Ferry, which took place in February 2009. This researcher formed part of the first group of four UP staff members to visit Tugela Ferry. She realised that a Tugela Ferry ICT4D project, still to be formulated at that stage, would provide a personally meaningful, socio-economically relevant and academically interesting research setting.

During the February 2009 visit, the UP team had interviews with respective people from the mission's school, medical centre and orphan care centre. This visit assisted with the scoping of UP's Tugela Ferry ICT4D project. After the visit, the research team, led by Krauss, started to search for project funding. The team was fortunate to obtain funding from UNESCO for the first phase of the planned ICT literacy training project. In liaison with the mission staff, the first training sessions were scheduled for July 2009.

8.7.3 The Tugela Ferry ICT4D project

8.7.3.1 Establishing community entry

The establishment of a relationship with key stakeholders at the Tugela Ferry community was far from self-evident. Although the UP project leader had personal ties at the mission, these ties were with Afrikaans speaking people and not with the key Zulu stakeholders that needed to, by themselves, express an interest in ICT training for their staff. The UP project leader, sensitised by a friend at the mission who acted as cultural interpreter, had to wait for an invitation from the head of a mission institution. It was important that the local community considered the training project to be initiated and managed by themselves. The UP project leader was patient as well as persistent, and continued to give the head of the institution regular courtesy telephone calls, without ever forcing himself or the intended project on the person. His patience was rewarded when, after some time, he received a phone call with a request for training, and associated terms of reference. This signalled the first of a number of ICT4D initiatives in the community, each requiring cultural sensitivity and similar persistence. The above is an oversimplified version of the process of community entry at Tugela Ferry, the details of which form part of the PhD of Krauss, the UP project leader, currently in progress.

8.7.3.2 The first series of IT literacy courses

During the July 2009 winter school holidays, three IT literacy courses were presented at the Tugela Ferry mission, at the computer centre of the mission school (Department of Informatics, 2009). The computer centre was established by the school shortly before, when they received 10 personal computers from the Department of Education as an award for excellent academic performance.

The first two IT literacy courses each took the format of a five day course that covered introductions to Microsoft Word and Microsoft Excel. In total, 24 people completed the Word and Excel courses. Of these, the majority were teachers. Also included in the 24 people were a handful of mission workers who were keen to develop their computer literacy. The course presenters were two faculty members of the University of Pretoria's Informatics Department, assisted by a colleague from the University of KwaZulu Natal.

The third course was aimed at basic computer appreciation for semi-literate mission staff and community members. It was presented more informally, in the afternoons after work, over a

period of two weeks. The presenter was a Zulu speaking colleague from the University of KwaZulu Natal. Five people associated with the mission completed this training.

Parallel to the second teacher training course, the most promising candidates that completed the first course received train-the-trainer instruction (Department of Informatics, ibid.). These candidates, mostly teachers, also helped to train the semi-literate course attendants, further assisting them in Zulu.

The majority of the people who attended training in July 2009 were school teachers. The word processing component of the training was meant to assist them in, among others, setting up question and papers in a professionally presented format. The spreadsheet training was meant to assist them in record-keeping and the processing of marks. The assignments for the first two courses were developed around such real-life applications.

Based on the success and feedback received from the first series of IT literacy training courses, another 10 people associated with the mission received MS Word and Excel training in April 2010, presented by the Informatics Department, UP.

8.7.3.3 Courses presented in partnership with the first trainees

One of the needs identified by the mission was IT literacy training for nurses at the mission medical centre. The nurses had a large administrative component to their work. The medication regime for the numerous TB and HIV/AIDS patients had to be meticulously recorded, not only for the benefit of the patients but also for the sake of ongoing multinational research projects based at the medical centre. As such, the nurses could greatly benefit from tools such as spreadsheet software.

The first part of the nurses' computer training was done by some of the newly trained teachers, after having received additional train-the-trainer instruction during a visit by the UP project leader in August 2009 (Department of Informatics, 2009). The UP team returned again later, to do final revision with the nurses, as well as course assessment and certification. The UP certified courses could only be assessed by UP staff members and not by local trainers. Ten nurses completed the IT literacy training, doing their MS Word exams in November 2009 and their Excel exams in July 2010.

Another round of IT literacy training was done at the mission school during the June/July 2010 school holidays, mainly for the teachers, and at their request focusing on presentation skills and Microsoft Powerpoint. Eight people attended a two day training course that was not formally assessed. Some of the previously trained teachers again assisted in presenting this course.

8.7.3.4 Financial and other resource constraints

The University team started to realise that the time, travel and cost involved for them to present training was not sustainable in the long run. They had to travel about 600 km from Pretoria every time along badly maintained roads, and had to incur costs associated with time away from work and home, travelling, accommodation and meals as well as the certification of the courses. The mission's own budgets were very tight and they did not have the resources to pay for the training, although they helped as far as they could, for example by heavily subsidising accommodation and meals. The University of Pretoria helped to finance the project, and the team was fortunate to receive money from UNESCO for the training presented in July 2009. However, they could not keep on depending on such income sources in the long term. A number of funding proposals were written, of which only the UNESCO proposal was successful. The ideal would be to establish a local IT literacy training centre that could sustain itself. A number of the mission people who were involved with the training up to this point, in particular the new local trainers, shared an ideal of helping to empower the larger Zulu community in this way. However, they were not sure how to realise this ideal.

8.7.3.5 To the next level: a locally owned and managed ICT training centre

During the UP training and research visit of June/July 2010, a research interview with a local community member affiliated with the mission, revealed that this community member had a vision to set up a computer training centre. Follow-up talks were held with the community member, who was also a local businessman. The joint planning between the businessman and the university required a very pragmatic approach and flexibility around the details. The university's certification arm was not used to work with local community agents, and the memorandum of understanding drawn up between them and the businessman required some innovation.

By early 2011, the businessman located a venue for a computer training centre, as well as a number of computers. In April 2011, a train-the-trainer workshop was presented by UP at the newly established computer centre in the Tugela Ferry town, to seven potential trainers, again

mostly teachers and mission members. Since this date, two computer literacy courses were presented by local trainers. 23 local people from the Msinga district completed the first training course, and 17 people completed the second course. A third course is in progress in October 2011, at the time of writing, with 18 local people attending.

The funding model for the training centre is currently a combination of local philanthropy, limited investment by the University of Pretoria, and course attendants who pay. The local businessman has put a significant amount of his own capital into the centre, to pay for rent and equipment. The return on investment will be slow, and his own passion to help develop the community as well as the trainers' commitment to work for a small salary, has helped to make the initiative financially viable. Local trainers had to go through a learning curve as to the most effective manner to present the course, in terms of the time schedule and presentation format. Trainees require substantial time to practise the exercises. If the trainers spend too many hours with trainees, it becomes unsustainable to the trainers. A balance had to be achieved and it appears that the training schedule has stabilised.

The setting up of the local training centre was a significant event to the UP team. It was something they envisioned but could not set up by themselves; local ownership was required. The reach of the training centre is already more than what they would have been able to achieve by themselves: 58 local people have already been trained or are currently enrolled, compared to the 34 that the university staff managed to train. Most of the people trained at the local training centre are from outside the mission. The UP team was keen for the wider community to benefit from an ICT training facility, and not just the mission staff. Although the training facility is not totally self-sustaining yet, and still requires advice and assistance from the university's project team, it has the potential to become fully self-sustainable.

8.7.3.6 Enabling a successful process: a reciprocal relationship

It was mentioned earlier that successful community entry was dependent on the assistance of local cultural interpreters, and by the cultural sensitivity of the ICT4D team, especially their project leader. Among others, the ICT4D team had to learn to accept Zulu hospitality outside of the project, and to give it as well. When visiting in Tugela Ferry, local people were always keen to receive project team members at their homes, and team members were often invited for dinner. This researcher at times felt awkward to receive this hospitality from people who were poor compared to her own standards. Yet, the team came to realise that community

members felt honoured to invite them and that these events were important to community members.

The UP team had the opportunity to also receive people from Tugela Ferry at their homes during the mission school's annual visit to universities, organised for their grade 11 scholars. During the mission school's campus trips of 2009, 2010 and 2011, university staff had the opportunity to receive the learners and their teachers, arrange a campus trip that entailed career education, and house the Zulu teachers and learners in the researchers' homes. The reciprocated hospitality became meaningful to the success of the IT training back in Tugela Ferry.

8.7.3.7 The 'C' in the ICT4D project

Although it is referred to as an 'ICT4D' project, it is evident from the discussion above that the intervention was limited to predominantly IT literacy training. The 'C' in 'ICT4D' did not receive explicit attention, as internet reception was not generally available in Tugela Ferry at the time of training. The handful of dial-up connections that were established by institutions were slow, costly and not generally accessible to staff. While the ICT4D team explored possibilities to establish internet access, the estimated initial and maintenance costs were far beyond the scope of their own funding, and funding proposals to large role-players were not successful.

The widespread uptake of mobile phones in the community, despite barriers of unreliable reception, cost and lack of access to electricity, indicate the importance that is locally attached to communication. At the time of writing, the use of mobile phones in the community was limited to voice communication only. Potential future availability of bandwith and smartphone handsets would open promising opportunities for future ICT4D work with a communications emphasis.

8.7.4 CATWOE description: serving system

The serving system's ICT4D initiative has a short term focus of performing a number of training courses themselves, and a longer term train-the-trainer focus. The latter involves a partnership with local entrepreneurs and assistance with the setting up of a local training centre. The CATWOE descriptions are different for the short term and longer term initiatives.

CATWOE description for short term initiative: UP team provides IT literacy training to Tugela Ferry mission staff.

Customers: Mission staff: school teachers, nurses and other care givers

Actors: UP Department of Informatics project team

Champions at mission as local organising team

Transformation:

Majority of mission staff not computer literate, transformed to majority of mission staff being computer literate

World view: ICT literacy as enabler of socio-economic development, via mission staff

Owners: Joint ownership between UP project leader and mission champions

UP as institution who underwrites training certificates

Environmental constraints:

Buy-in and commitment of key mission stakeholders

Social acceptance of UP training staff

Availability of training facility with electricity

CATWOE description for longer term initiative: UP team facilitates setting up of local training facility.

Customers: Local residents of Msinga district

Actors: Local entrepreneurs/visionaries to set up training facility

UP Department of Informatics as facilitator

Transformation: Setting up locally managed ICT accredited training facility

World view: Local economic development via a sustainable ICT training facility

Owners: Joint ownership between UP project leader local entrepreneurs

UP as institution who underwrites training certificates

Environmental constraints:

Local entrepreneurs with ownership and perseverance

Sustainable local client base

8.7.5 Conclusion

The ‘serving system’ has successfully completed a number of training courses to one of the social ‘systems served’, namely the Tugela Ferry mission. In the longer term, the local

training facility is expected to have a direct impact on the larger 'system served', namely the Zulu community.

With this, the contextual descriptions of the social systems of interest on the ICT4D project are concluded. In Part III that follows, an entirely different aspect of the preparation for a systems description is provided, namely the modelling assumptions and simplifications.

Part III: Modelling preparation

8.8 Assumptions and simplifications

In Part III, the remaining aspect of the preparatory work is discussed: the stating of assumptions and simplifications that are made as part of the systems description and the application of theory. The assumptions and simplifications are informed by the contextual descriptions in Parts I and II, and also indicates the way that systems thinking in general and the systems framework in particular is being applied to model the social environment in the study.

8.8.1 Being functionalist or interpretive

The research philosophy of this study is interpretive. The research methodology chapter discusses and motivates the choice of an interpretive philosophy (see section 3.2.6). An interpretive approach is suited to ICT4D case study research within the "social embeddedness" stream of assumptions, and Klein and Myers' (1999) principles of interpretive field work is accordingly applied. The theoretical framework of the study is a social systems framework, where the definition of a system, namely a subjective mental construct, is in line with interpretive thinking. The two underlying theories of the framework are Giddens' structuration theory and autopoiesis theory. In section 3.2.6, it was argued that Giddens' (1984) structuration theory as well as Maturana and Varela's (1987) autopoiesis theory each contain aspects of interpretive as well as positivist thinking, but can be largely classified as interpretive.

When systems thinking is applied by means of a biologically based model, it retains functional aspects. In the systems framework of this study, social systems of interest are modelled as ideal types, with assumptions about boundaries, and generalisations about the social behaviour that characterise social systems. Biological concepts are subsequently applied to the modelled systems. Giddens, an outspoken non-functionalist, is critical towards studies that regard communities as "easily distinguishable … as biological organisms are", and where there is a "fascination with 'value-consensus' … at the expense of the more mundane, practical aspects of social activity" (Giddens, 1984: xxxvii). Giddens' view is acknowledged but not shared by the researcher. In this study, the functional aspects are meant to complement the interpretive stance rather than counter it, making use of the social as well

as natural sciences, as possibly intended by Checkland (1999) in his claim that a social system has aspects of a natural system as well as a human activity system.

8.8.2 Selecting the Zulu and mission communities as systems of interest

The Zulu and mission communities are selected as systems of interest because they represent the key stakeholders of the ICT4D project. Both communities are 'systems served' in Checkland and Holwell's (1998) definition of an information system.

The mission community is a direct client and co-initiator of the ICT4D project. The ICT4D team had to successfully engage with mission workers, and take effort to understand and respect their biblical value system in the process. The latter point was especially important given the mission's aim of practically living out their value system rather than just preaching it. ICT4D team members were the guests of the mission and were seen as belonging to the mission while undertaking their project. As such, they had to live the value system of the mission. For example, female ICT4D team members had to wear loose fitting, long dresses or skirts, as this is the required dress code for mission workers.

The Zulu community is the 'system served' of the mission. The ICT4D project assisted the mission with the eventual aim of helping its members to better assist the Zulu community, in areas such as education, medical and social care. In addition to being an indirect 'system served' of the ICT4D project, almost all mission members and the majority of mission workers are Zulus. These people have abandoned some aspects of Zulu culture such as ancestral worship, but their daily social interactions are still based in their Zulu culture overall. For this reason, the ICT4D members had to learn to engage with Zulu people. Also, the ICT4D team was in Zulu tribal territory while doing their project and had to socially interface with Zulus outside of the project.

The eventual aim of the ICT4D intervention is not only the successful interaction with the two mentioned communities; it is the socio-economic development of the Zulu community at large. As such, the Zulu community and their dynamics had to be understood, to ascertain how the ICT4D project could influence these dynamics towards socio-economic development. The dynamics within the mission had to be understood, as well as its influence on the Zulu community, in order to ascertain how an ICT intervention at the mission could affect the Zulu community at large.

8.8.3 Zulus and the mission: separate social systems or not

Since almost all mission congregation members are native Zulus, the mission is strictly speaking contained within the Zulu community. However, the mission culture and mission values are very distinct from (although to an extent influenced by) traditional Zulu culture with its ancestral belief system, patriarchal system and polygamy. Zulus joining the Tugela Ferry mission church are requested to totally renounce the ancestral belief system and to take on new family values that exclude total male domination and polygamy. This also differentiates the Tugela Ferry mission from some other Christian churches operating among the Zulus, who accommodate more of the traditional Zulu practices and the practice of syncretism. The Tugela Ferry mission is thus at great pains to differentiate themselves from traditional Zulu cultural, belief and social practices. At the same time, some Zulu social practices are continued and accepted within the mission congregation, because they do not clash with biblical values. Examples are social habits not involving ancestral worship, and the implicit age related social hierarchy of the Zulus.

Since the way that social systems are defined in this study, is in terms of social and cultural practices, the mission is by implication a separate social system.

Initial exposure to the Tugela Ferry community made the researcher realise that if IT training is to be performed in association with the mission, for congregation members and possibly later non members, it will be necessary to understand mission culture and practices as well as traditional Zulu culture and social practices. Even if Zulus at the mission have moved away from their deeply traditional culture and beliefs, they still retain a certain way of thinking that can only be understood by studying the deeply traditional Zulu culture as well.

As such, it makes sense to the researcher to define the mission and traditional Zulu cultures as two distinct social systems, for purposes of analysis.

8.8.4 The question of boundaries

Mingers (2006) indicates that as systems move from the physical to the social, their boundaries become less easy to discern. The only clear boundaries are those of “ideal type” systems.

In autopoiesis theory, the boundaries of a system are created as part of the self-production process. The two systems investigated here are social systems, identified by respective sets of cultural practices. As such, the exercising of the social and cultural practices would serve to identify what is inside the system. By implication or inference, these boundaries can then be drawn around people as well. However, when it comes to classifying people of the community into these systems (or not), things are not so clear cut.

Ideally, the members of the mission church are identified by their behaviour. The leadership of the mission church have realised that in the Zulu community, where people's personal lives are very transparent and not very private, one's deeds carry a stronger message than one's words (Respondent3, Respondent5). The "counter" value system preached by the mission church is constantly reinforced, in preaching, bible studies and so forth. The leadership as well as church members that were observed, make a conscious effort to enact that behaviour. It is important to the identity of the church that people do not send mixed messages into the community. However, people are human beings and one cannot extrapolate from the most active members of the church. It is acknowledged that the value system of the church is not (and cannot possibly be) in practice enacted consistently. However, the value system of the mission remains their identifying characteristic. It is also the case that the Christian church allows for error, provided that it is followed by some acknowledgement or confession, and attempts to rectify or improve the behaviour. The assumption will be made that the mission's value system is generally enacted within the mission, forming a boundary by distinguishing what is part of the mission and what not.

In the Zulu system, the situation is that one is born into a Zulu tribe. It is seldom if ever the case that a person not born Zulu is accepted as a Zulu. In practice, Zulus who migrate from the area into a more multicultural environment, can marry into other South African cultures or even non South Africans. Zulus moving into the cities may also choose to leave behind their social practices. However, the demographic data for Msinga shows the homogeneous character of the community, where over 99% of the population consist of Zulu speaking black Africans, and virtually no migration of other cultural and language groups into the area. According to Respondent5, the Zulu habits (as a whole) may be changing over time, but the people in the Msinga area remain a homogeneous group even today.

8.8.5 Organisational closure and autopoietic nature of systems

Before applying autopoiesis concepts to a social system, is it necessary to assume that the social system of concern is self-producing, has its own boundary and is organisationally closed, in other words, that it is autopoietic? These questions form part of the controversy around the social application of autopoiesis, and is discussed in detail in Chapter 6. In section 6.3, it is shown that there are different camps in the literature. It is noted that Varela himself does not believe that autopoiesis can be directly applied to social systems (Varela, 1981: 38), while according to Luisi (2003), Maturana is more open to the idea. Some scholars argue that social systems are autopoietic and autopoiesis principles can be applied to them directly (e.g. Zeleny and Hufford, 1992). Some scholars argue that social systems can only be autopoietic in the metaphorical sense (Morgan, 1986). Yet another group of scholars argue that social systems have to be defined in a special manner in order to arrive at an autopoietic construct (Luhmann, 1990; Mingers, 2004). Of the suggested social conceptualisations of autopoiesis, there are currently none that can withstand a strict assessment of their propositions against autopoiesis theory.

Section 6.3 also refers to a substantial group of scholars who socially apply the principles of autopoiesis and derive benefits from it, without indicating a need to claim that a social system is autopoietic or even organisationally closed. In this study, the latter group of scholars are followed, and autopoiesis principles are applied without claiming or even making assumptions upfront such as that a system is organisationally closed. While the restrictions are lifted in this manner, it is still believed necessary to have a proper social conceptualisation of autopoiesis, that is internally coherent and adequately reflecting the social nature of the social system. This is provided with the structuration based conceptualisation of a system presented in Chapter 7.

8.8.6 Homogeneity in the Zulu and mission communities

The demographic data in section 8.2 indicates that more than 99% of residents in the Msinga local municipality are Zulu speaking black Africans. Of these, roughly 80% have deeply rural subsistence livelihoods, including that they live in traditional dwellings, do not have access to electricity or running water inside their yards, and that the adults in the household are illiterate. Children walk long distances to school. A large amount of household members' productive time goes towards fetching wood and water, in addition to household chores such as preparing meals, washing clothes, and perhaps tending to livestock and a vegetable garden.

These people often live so far from main access roads that they are not able to commute to a daily job, the latter of which there are not many available. Their typical means of income are estimated to be a combination of social welfare grants, the income of a family member who is a migration labourer, and informal trade. Based on personal observation and informal discussions, most traditional Zulus are assumed to have ancestral rites as part of their cultural practices, which do not necessarily preclude them from also belonging to a religious institution such as the Zionist Christian Church or Shembe church.

Roughly 20% of people live in modern brick houses, have electricity in their houses and running water nearby, not necessarily inside their house. They live adjacent to a small town or have a means to access it. It is estimated that at least one of the adult family members are literate and have formal employment. Children have access to better resourced schools. These people do not participate in ancestral practices as actively as their more rural counterparts.

Since the mission headquarters is on the outskirts of the town, and walking distance from the town centre, it is estimated that the majority of congregation members fall in the 20% category of Zulus who are relatively speaking more affluent. Families who send their children to the mission school fall in this category, since they manage to afford the schools fees that are higher than at government schools. Mission staff also falls into this category. The mission does have satellite church buildings distributed throughout the remote areas, and the people involved at the satellites would be from the 80% of Zulus who live remotely and are financially speaking more poor.

Although the two social systems are defined in terms of their social practices and not groups of people, there is a mapping to real communities. The Zulu social system will map largely to the 80% of Zulus with a rural, traditional lifestyle. The mission social system will map largely to the 20% of more affluent Zulus who are also members of the mission church.

8.8.7 An assumption related to the serving system

The research approach followed in this research project is, in the ICT4D context, a “social embeddedness” approach (Avgerou, 2009), similar to Silva and Westrup’s (2009) “emerging understanding” approach, which is sensitive to the local context and its needs. It is assumed that the whole ‘serving system’ follows this ICT4D approach. This is not entirely true, since the ICT4D project leader follows a combination of an interpretive, context sensitive and a critical approach in his research. However, the project team as a whole makes an effort to

individually and jointly learn to understand and respect the local Zulu as well as mission culture. Mission church services are jointly attended and after-hours social interaction with community members is encouraged.

8.9 Conclusion

With the use of the systems framework, this chapter has laid the basis for a systems modelling exercise. It has simultaneously presented a thorough description of the overall social context of the ICT4D project. The research proceeds in the next chapter with analysing the case study data to perform a systems description and analysis. The systems description and analysis will work towards showing the impact of the serving system, the ICT4D project, on the systems served, namely the Zulu and mission social systems.

Chapter 9 Description of social systems

9.1 Introduction

In this chapter, the main section of the social systems framework is applied to the social systems of interest on the ICT4D project. The social systems are modelled or described using concepts from structuration theory and autopoiesis. In the process, it addresses the following research question:

- How can a systems framework based on social autopoiesis be practically applied in a deeply rural community in a developing country?

Each social system is described separately before the mutual influences between the systems are studied. The descriptions are presented in a particular order. The largest system served, the Zulu system, is described first. The mission, which is a serving system to the Zulu system, but represents a system served to the UP ICT4D project, is described next. Following this, the mutual influences between the Zulu and mission systems are assessed. Lastly, the serving system of this study, namely the ICT4D project, is described. Having done this, the mutual influences among the three systems, but in particular the influence of the serving system on its two systems served, is investigated. This description is used as a basis for the assessment of the impact of the ICT4D project on its systems served.

The background study of Chapter 8 informs the systems descriptions, while the main source of information is empirical data gathered during the case study. The empirical data collection process is revisited before commencing with the systems descriptions.

Why are the systems descriptions done in this manner? The ultimate purpose is to develop an in-depth understanding of all three systems, and their mutual interfaces and influences. *This is done to see whether and how the serving system(s) can influence the self-producing ability and sustainability of the systems served. In this way, the contribution of the ICT4D project to the socio-economic development of the systems served can be assessed*, given the definitions of development presented in Chapter 2. As indicated in ICT4D literature (e.g. Walsham et al., 2007; Silva and Westrup, 2009; Heeks, 2008), there are requirements for successful interaction, such as that the serving system(s) must remain sensitive to the worldviews, values, and authority structures of the systems served. This study highlights such imperatives,

and discusses them under the headings of the systems framework. However, the study wants to go beyond that, to see how the essential social character or nature of each social system comes at play and is influenced during social interaction, to ultimately assess how sustainability and socio-economic development are impacted.

9.2 Empirical data gathered

The context of the ICT4D case study is given in Chapter 8. The setting of the case study is the systems served, namely the Zulu and mission systems within the Msinga local municipality in KwaZulu Natal, South Africa. The case study's ICT4D project is described as the serving system, also in Chapter 8.

In the section below, the data collection process presented in Chapter 3 is revisited, and the data obtained during this exercise are discussed.

9.2.1 Revisiting the research methodology

Chapter 3 discusses the research philosophy and overall methodology of the case study. In that chapter, motivation is presented for the undertaking of an interpretive ICT4D case study, following Avgerou's (2009) "social embeddedness" set of assumptions. A longitudital, single, descriptive case study has been conducted making use of Klein and Myers' (1999) principles for conducting interpretive field studies. The systems framework in Chapter 7 provides the theoretical lens used for data collection as well as analysis.

9.2.2 Nature of data collected

This study focuses on the social context of an ICT4D project, here defined as social systems of interest, with modelling assumptions as discussed in Chapter 8. The empirical data collected is social in nature, and therefore qualitative. Quantitative demographic data obtained from secondary sources has been used in the background study (Chapter 8) to link the social systems with real-world communities. The qualitative empirical data collected during this research project describes the social nature and dynamics of the social systems of interest.

9.2.3 Data collection methods

Typical case study methods were used, namely interviews and the studying of documents (Myers, 2009: 79). The ethnographic methods of participant observation and daily field notes (Oates, 2006: 174) were used to obtain additional rich data during field trips.

9.2.3.1 Interviews

Ten formal, scheduled interviews took place, distributed over the period covered by the field visits listed below (Section 9.2.4). Seven of these interviews were voice recorded. With the other three, an alternative recording method was experimented with: detailed notes were taken during the conversation, which were typed up the same evening with annotations, the result of which was verified with the respective respondents. Whereas the researcher was more comfortable with the latter method, she realised that a recorded interview presents a more complete record of the conversation. The scheduled interviews were all semi-structured, that is, the interviewer asked open-ended questions related to the concepts of the systems framework. Whereas in initial interviews, the concepts of the framework were presented, the researcher subsequently realised it was inappropriate since they were formal, academic concepts. Thereafter, these concepts were not directly presented to the interviewees; instead, the researcher translated the framework concepts into questions that were directly relevant to the life world of the interviewees. As part of the interviews, people were asked to volunteer their life stories. Rich sets of data were obtained within which the researcher could search for information pertaining to the systems framework.

In addition, a large number of informal interviews took place during field trip activities, many of which were unplanned and occurred as the opportunity arose. These were documented either during the event, in the researcher's notebook, or otherwise on the same evening as part of the daily recording of field notes. Informal conversations with the researcher's own project team and particularly with the project leader, in the field or back at the university, were important contributions to personal sense-making.

Informed consent was obtained from all individuals with whom scheduled interviews took place, as well as in cases where informal conversations became important information sources. Where people signed consent forms, the information they supplied is referenced in descriptions below by a respondent number. Other informal conversations are used in data analysis in the same way as field notes, as part of the general description.

The majority of interviews were with people associated with the mission, since these people were accessible to the researcher and could speak English. One scheduled interview was done with a traditional Zulu man who was not a member of the mission church and who could not speak English. The interview required a whole delegation to facilitate it: a male from the mission to address the Zulu man, a Zulu lady who was fluent in both Zulu and English to translate, the researcher as well as a university colleague who observed. Each question went from the researcher to the lady who translated, to the male from the mission who addressed the traditional Zulu. When the Zulu man responded, the information was relayed back in the same manner. This interview only became fruitful when the researcher released control and allowed the traditional Zulu man to volunteer information as he chose.

9.2.3.2 Documents

Documents related to the IT training project as well as to the community were collected. For the IT training project, these include funding proposals, project reports and some meeting minutes. For the two social systems served, not much was readily available that was formally documented. Two meaningful documents obtained were the Msinga Municipality's Integrated Development Programme and an issue of the mission school's magazine.

9.2.3.3 Participant observation

Participant observation included observing those who were participating in the IT literacy training: course presenters as well as attendants, during training sessions as well as outside the training venues. Outside of the formal training, planning meetings were held and informal conversations were observed between trainers as well as between course participants. Other observation opportunities arose while participating in activities of the mission as well as general socialising during field visits.

During the IT literacy training the researcher participated in the needs assessment, planning and writing of funding proposals for the IT literacy training. During the training itself, the researcher did not formally present but assisted with practical class exercises. She further sat in during training sessions as an observer and informally conversed with trainees.

Participating in activities of the mission included attending church services as well as accompanying mission staff on a number of mission activities. In July 2009, the researcher went along during a series of evangelisation home visits to people in a very remote area, accessible only by foot. Four Zulu families were visited, two of whom were active members

of the mission congregation. The delegation sat with the families in their homes, read a passage from the Bible to each, listened as their personal needs were discussed, prayed for them and handed out food and clothes to the most needy of the families. In July 2010, the researcher went along with a worker from the orphan care centre to deliver monthly food parcels to the families caring for AIDS orphans. A pickup truck was loaded with the ingredients for the food parcels, namely maize meal, rice, beans, salt, cooking oil, instant mash, fresh spinach and lettuce. The pickup truck had to travel along tracks in the rural area, many of which were difficult to travel on and not accessible by a sedan car. Although the researcher could not understand much of the conversations that took place in Zulu, she could observe the circumstances in which the people lived as well as their gratefulness for receiving food from the mission. Another visit took place in July 2010, this time accompanying a social worker from the mission's health care facility. The social worker visited two remote families who were in need of social welfare assistance as well as medication. The social worker could speak English and answer the questions of the researcher. Long distances were again covered along inaccessible roads, to people who were very needy.

Social interaction during field trips was one of the highlights of the research and IT training project. The Zulu as well as Afrikaans people associated with the mission were very hospitable, even though they were poor compared to city standards, and keen to receive the university staff at their homes. The same was true when interacting with traditional Zulus not associated with the mission. The group from the university ended up dining and visiting at a number of homes, learning about local cuisine, local social habits as well as the lives of the local people in general.

Another series of social interactions took place when people from the mission school visited the university during their annual campus trip for senior scholars. During the campus trips of 2009, 2010 and 2011, the university staff had the opportunity to receive the learners and their teachers, arrange a campus trip that entailed career education, and house the Zulu teachers and learners in the researchers' homes. The reciprocated hospitality became meaningful to the success of the IT training back in Tugela Ferry, as will be discussed in the data analysis sections.

9.2.3.4 Field notes

After the fact-finding visit in February 2009, each subsequent visit entailed taking extensive field notes on a daily basis. The field notes, which amount to 50 pages of single spaced

typing, include for each day, a diary-like record of events, the data collected during participant observation, recording of informal interviews as well as personal notes: the emotions, impressions and research reflections of the researcher.

9.2.4 Time period

Data has been collected since the first visit to the Tugela Ferry community in February 2009, up to the most recent visit in March 2011. These visits represent five field trips to rural KwaZulu Natal. All visits were associated with the ICT4D training project. From the second visit onwards, each trip involved some kind of IT literacy training. As discussed, this researcher was involved in the training as assistant and observer. Time outside the training sessions was used to study the community in an ethnographic manner. The dates of the field trips were as follows:

19 – 21 February 2009
28 June – 4 July 2009
7 – 10 April 2010
4 – 10 July 2010
11 – 13 March 2011

The extended periods between data collection opportunities allowed for the outcomes of the first training sessions in 2009 to be assessed during subsequent visits. It also allowed for observing how the project evolved over time, and how the approach of the trainers evolved as they gained experience in the particular context. Preliminary interpretation of data collected during the earlier visits was discussed with key people in the community during the last two visits, in order to get their feedback and confirmation.

The time period of just over two years, with repeated cycles of being at the community and away from it, was essential to the researcher's hermeneutic process of sense-making of the situation. During periods away from the community, the researcher reflected on the theoretical framework, the data collected as well as personal experiences in the field. These reflections, together with continual further reading back at home, informed the development of the theoretical framework as well as each subsequent data collection exercise.

9.2.5 Ethical matters encountered

During the data collection process, a number of situations arose that called for sensitivity around research ethics. The first was to obtain informed consent from interviewees who were illiterate and non-English speaking. The university's requirement was a signed informed consent form. The university's ethical committee made the concession that the researcher could obtain verbal informed consent via a translator, and record the conversation. However, when these situations arose, the interviewees were happy to sign a form once it was explained to them. The researcher realised that the underlying ethical concern was not to get the forms signed, but the implicit trust that the interviewees placed in her while they did not have a frame of reference to judge the potential implications of sharing information. The researcher regarded it as an ethical burden on herself not to abuse this trust.

Another matter involving trust was encountered when interviewing Zulu females, of which some conversations took place in English and one involved a translator, who was also female. The Zulu females openly shared intimate personal information with the researcher, with whom they identified with as a female. This was in contrast with Zulu males, who were more reserved during conversations, except if they were interviewed in a formal context such as their work office. Similar to the informed consent situation, the researcher realised she was trusted with more than what she would have been in a western environment, requiring her to take special care with the information shared.

After the researcher commenced with data analysis, some interviews were held to confirm with key stakeholders the provisional conclusions drawn. In one instance, the researcher was asked to remove the discussion of a particular matter from her thesis, as the matter was regarded to be polically sensitive within the community. The researcher realised that her own outsider's judgement of what was sensitive to the community did not necessarily correlate with the research participants' perceptions. Fortunately, the mentioned matter was not central to the thesis, otherwise she would have faced a more serious ethical dilemma.

9.3 Relationship between data collection, data analysis and theory development

As mentioned in section 3.5, an iterative process was followed of doing data collection and analysis while simultaneously developing and refining the theoretical framework. During each subsequent visit to the case setting, new insights were gained about the community

investigated, as well as about the ICT4D project. Between visits, reading and reflection were done on the theoretical framework and how it could best be applied, taking into account the incremental knowledge gained about the case setting. The refinement of the framework in turn sensitised the researcher to view the case setting in new ways. The process of iterative sense-making is summarised in Figure 9.1 below:

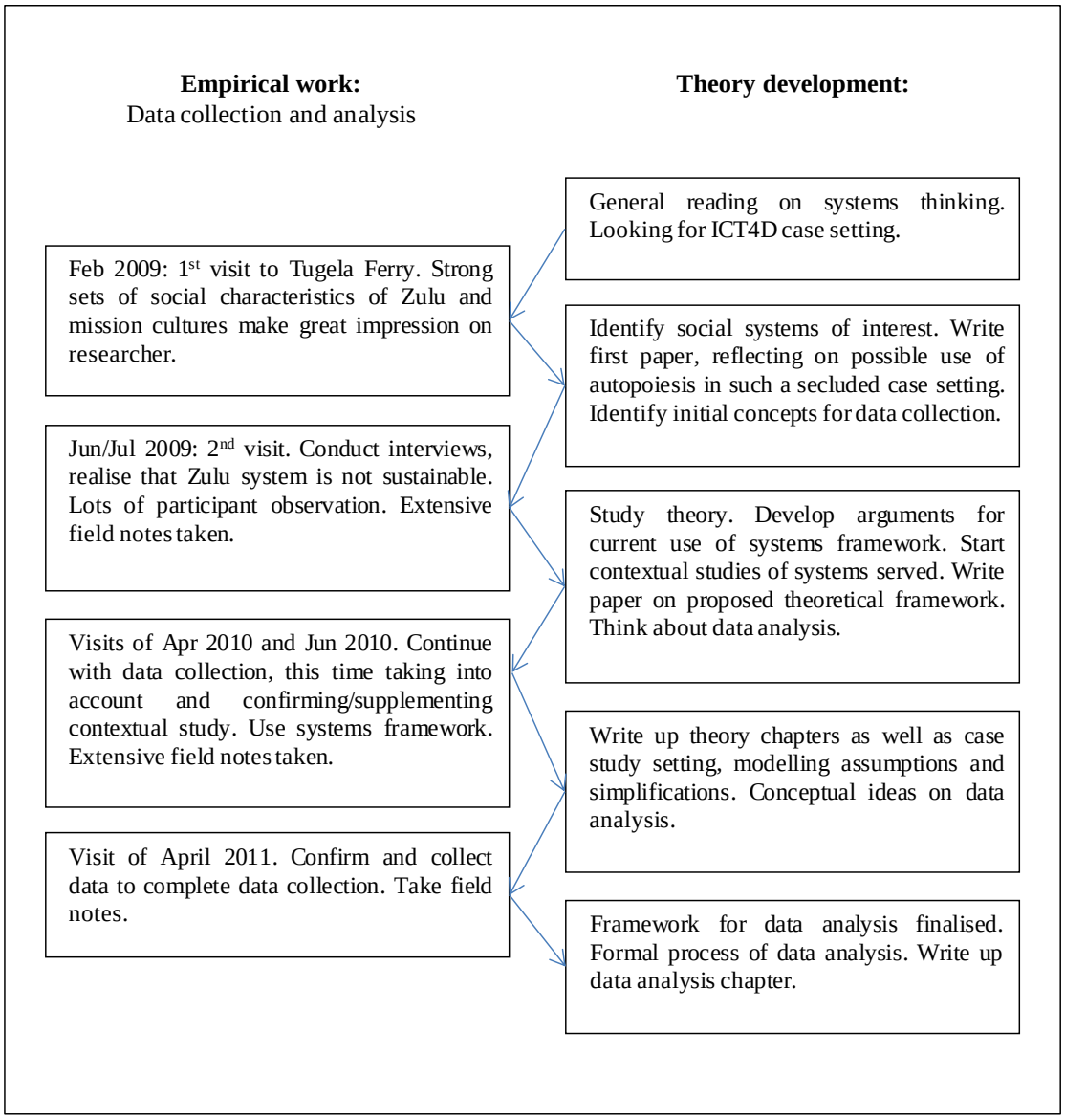

Figure 9.1: Iterative process of data collection, analysis and theory development

9.4 Revisiting and applying the systems framework

Preparatory work
Background sketch, including a **CATWOE description** of each system Stating of **assumptions and simplifications**

Concepts of structuration: description from within the systems				
Giddens' dimension	Structure of signification	Structure of domination	Structure of domination	Structure of legitimation
Element of structure:	**Rules (interpretive)**	**Resources (allocative)**	**Resources (authoritative)**	**Rules (normative)**
Modality:	Interpretive schemes	Facility	Facility	Norms
Element of action:	Knowledgeability (of interpretive rules)	Capability (to apply allocative resources)	Capability (to apply authoritative resources)	Knowledgeability (of normative rules)
For a social system: **Rituals** (notion of temporality: everyday, lifetime and institutional time spans) **Social practices**				

Concepts from autopoiesis theory: looking at the systems from outside	
Use Giddens to describe:	**Organisation:** identifying characteristics, in terms of social structure above Structure: social practices **Drift**: changes to social structure as well as social practices over time **Organisational closure:** degree of continued autonomous existence **Structural coupling:** interfacing with other social systems
Derived concept:	**Sustainability**

Table 9.1: Elements of the social systems framework

The following notes on applying the systems framework are relevant to all descriptions of social systems that follow:

- The information presented below is sourced from records of empirical data, such as field notes and recorded interviews. This information is supplemented and contextualised making use of the background study presented in Chapter 8. Where a particular person is referenced, this is indicated by a respondent number.

- In this study, a system is regarded as a subjective mental construct. It is the construct of the researcher.
- Generalisations are often made, and systems modelling requires one to work with ideal types.
- Giddens' dimensions of duality of structure are not mutually exclusive. Often, an information aspect has bearing on two or more of the dimensions. For example, the ancestral belief system is relevant to daily sense-making (interpretive scheme), and is also a source of authority (authoritative resource). As such, information may be repeated but with a different focus.
- For the sake of applying autopoiesis principles, the social system is first defined making use of structuration theory. As such, the notions of 'organisation', 'structure' and 'drift' will not be discussed if this means repeating data previously presented. 'Organisation' refers to the social system's key identifying characteristics, 'structure' to the associated social practices, 'drift' to the organisational as well as structural changes to the system over time, all of which are discussed under the structuration theory headings. 'Organisational closure' refers to the extent to which a system's organisation contributes to its continued autonomous existence. 'Structural coupling' refers to the interfacing of the system with surrounding or neighbouring social systems.
- Related to the previous point: while all of the concepts in Table 9.1 above have been used during data collection, only the systems concepts printed in **bold face** in Table 9.1 will be used to describe the system in the sections that follow. This is for the sake of parsimony; the sum of the bold face concepts has been found to be representative of the systems theory.

9.5 Description of system served: the Zulu system

The Zulu social system is the eventual system served by the mission, as well as by the ICT4D project. This system is also the one that is, from the researcher's perspective, the most 'different'. As such, its description is more detailed than that of the other two systems. While researcher remains an outsider to the Zulu system, her description and analysis was confirmed as an accurate portrayal by a senior colleague from a neighbouring traditional African culture.

The Zulu social system is currently confronted with many changes in their social environment, which in the long term impacts on their culture. Since their current social structure is still rooted in the traditional Zulu culture, the structurational view will describe

the traditional Zulu social structure, after which changes occurring in the culture are described.

9.5.1 A structurational view

9.5.1.1 Interpretive rules

Traditional Zulus have a strong social identity, and in this case it means that belonging to a group and social acceptance by peers is more important than individual self-expression. Sense-making of a situation takes into account one's social identity. As part of their social identity, people in this community identify with each other and care for each other. Caring is a social value that is discussed under the normative rules below.

An ancestral belief system provides a way of interpreting everyday events. For example, hardship or illness in the family is interpreted as a situation that needs to be rectified with the ancestors (Respondent5). In traditional Zulu culture, a sangoma is consulted to tell the person what problem the ancestors have, and how to rectify it.

Traditionally, horizontal and vertical social stratification guide the way social events are interpreted. Horizontal stratification is according to surname families. If my surname is Zuma and another person's surname is Zuma, I treat the person as family even if I don't know them. Some surnames are related, meaning that they belong to the same surname family. An example of how surname families influence behaviour is that when a school teacher disciplines a child of a particular surname family, the child's class mates of the same surname family will identify with the child and possibly come to the child's defence (Respondent6). Vertical stratification is a complex structure influenced by age as well as gender, and will be discussed further under normative rules. An example of how a position in the age/gender structure leads to a traditional interpretive scheme is that a young woman who has come of age but is still a virgin always carries a white handkerchief with her. The handkerchief symbolises her virginity, and a male suitor will jokingly try to grab the handkerchief (Respondent5).

The isiZulu language provides the linguistic context for Zulu sense-making. A number of mission members who are fluent in Zulu but not native Zulus (e.g. Respondent5), have commented that certain isiZulu phrases and idioms cannot be translated into English or

Afrikaans; these are unique to the Zulu cultural context. The majority of people in the area are fluent in isiZulu only.

9.5.1.2 Allocative resources

Collectively, the primary allocative resource of people in the Zulu tribal system is land. The Zulu tribal area is located within the KwaZulu Natal province and forms a subset of the province. Tribal land is located in patches rather than with neat boundaries. The Msinga local municipality all falls in the Zulu tribal area. The Msinga municipality has six chieftains, and the local tribal chief of each has the discretion to allocate land. If someone is not a Zulu they may be granted permission to occupy and utilise premises in the area. However, the land does not belong to them and reverts back to the Zulu tribe along with improvements made, at the chief's discretion or when the occupants decide to leave. This allocative resource has been instrumental in keeping the Zulu culture intact. Migration figures of non-Zulus into the tribal area are extremely low, as shown in Chapter 8. At the same time, the land ownership system has been a key factor in limiting or constraining economic development. It has discouraged companies and industries from investing in the area (Respondent1). Even Zulu people themselves do not have title deeds for their stands, meaning that they do not have an asset to sell or borrow against. It also means that no land taxes can be collected, so that the local government does not have its own source of income (Respondent1).

Traditionally, the primary allocative resource at individual or household level is a household's livestock. People farm chicken, goats and cattle, cattle being the most valuable. Historically, a herd of cattle has been treated as a fixed asset and cattle were only slaughtered on very special occasions, such as a funeral. The neighbourhood were invited to participate in the event and all the meat was consumed at the function. This was a practical way for people to deal with a large amount of meat, since there were no fridges or other ways to preserve meat (Respondent5). Traditionally, cattle continue to play an important part in traditional lobola or brides-gift arrangements. The brides-gift, to be paid by the groom's family to the bride's family, usually consists of a number of cattle, as negotiated between the male representatives of the respective families. (Respondent8). The above examples where cattle come into play are socially grounded events that by their nature involve extended families as well as neighbourhoods. These examples stress the social nature of the Zulu culture.

The traditional Zulu economic system is a subsistence livelihood system. The subsistence livelihood system precedes notions of money or capitalism and is not geared to generate

surplus cash. In Chapter 8 an explanation is provided as to how the subsistence livelihood system came under pressure during the previous century, since the natural resource base it requires per capita to be sustainable, has shrunk significantly. At the same time, because of various events and changes, the demand for cash by the Zulu household has increased. During a large part of the 20th century, migrant labour, in particular men working on the mines, assisted to satisfy the demand for cash. However, in recent decades employment opportunities for semi-skilled labourers have significantly decreased.

In most cases where Zulus were interviewed by the researcher, it was found that the persons achieved what they did in their life despite a severe lack of allocative resources while they grew up. People interviewed typically suffered severe hardships while they grew up, but nevertheless persevered in completing their school education, which helped them to get employment. Such hardships included walking long distances to school, being the breadwinner of an extended family while simultaneously having to pay one's own school fees, implying long working hours after school and on weekends, and alternating years of study and work in order to save up for each following year of study. For women, it included surviving periods of hardship, in one case literally famine, rather than marrying an abusive husband for the sake of financial security (Respondent2, Respondent1, Respondent7, Respondent8).

The HIV/AIDS pandemic of recent decades has placed an additional financial burden on people in a number of ways. To consult a herbal doctor or a sangoma costs money. The loss of productivity due to illness means that the sick person cannot contribute to the household's livelihood. A funeral is a large social gathering that requires at least one beast to be slaughtered. If the family does not own cattle, a cow or ox needs to be purchased for the funeral, often leaving the extended family in debt: "*You are suffering because you lost your loved one. You are suffering because you must get money to buy food to give to all these people who come to the funeral*" (Respondent7). AIDS related deaths are most prevalent in the economically active age groupings, and children end up being raised by a single parent, grandparents or other relatives, resulting in further economic hardship.

During field visits, it was observed that even the poorest households have mobile phones. People regard the ability to communicate as essential. This need is magnified by the remote location of households and people's social identity (Respondent5). However, there are regular cost implications such as travelling to and paying to charge your phone at an electricity outlet and buying air time. Whereas a mobile phone is a relatively small expense for a person with a

professional income, it is a large expense if one has a subsistence livelihood with no regular income at all. Similar continued demands for cash and the simultaneous inability to generate cash has, over time, depleted the allocative resource base of the typical rural Zulu household, to the extent that many families are not in a position to sustain themselves any longer.

Given the current situation with regard to the subsistence livelihood system, and an employment rate of 21% (see Chapter 8), a large percentage of Zulu families are dependent on social welfare grants as an essential allocative resource. Social grants are available as social pensions for the elderly, disability grants and child grants for mothers without an income. One social grant often has to support an entire household. Several interviewees stressed jobs as the thing that will most improve people's lives (e.g. Respondent1, Respondent7).

Other allocative resources that are relevant to the rural Zulu social system, are infrastructural resources such as roads, water supply, sanitation and electricity. Chapter 8 has shown that 80% of Zulu households in the Msinga municipality are without these resources, even though the current government is working hard at changing the situation. An example of how government is trying to help the community while developing infrastructure, is an initiative where 105 previously unemployed matriculants in Msinga municipality have been given jobs as part of a local waste water management project (Sigogo, 2011).

According to (Respondent4), the Zulu community is not handling inequality or differentiation in allocative resources well. This may be ascribed to the collectivist culture. For example, a person who has a regular income is in principle expected to financially assist the entire extended family. While this practice helps poor relatives to survive, it places a burden on the income earners. Also, "*people are jealous towards a person that is getting ahead in life*" (Respondent4). A capitalist value system that encourages the accrual of allocative resources at individual level appears to be in conflict with a collective value system.

9.5.1.3 Authoritative resources

Traditionally, Zulu tribal authority has been a significant authoritative resource (Respondent4, Respondent5). Under the Traditional Leadership and Governance Framework Amendment Act of South Africa (41/2003), tribal chiefs can allocate land, act as judges in tribal courts and make decisions concerning tribal matters. As discussed in Chapter 8, the fact that national and

local government bodies control the budgets for all infrastructure projects in the Msinga municipality has led to the erosion of tribal authority. "*Money has the power*" (Respondent5).

Another key authoritative resource is the power that the ancestors are assumed to have in the ancestral belief system. Zulus have traditionally made an effort to keep the ancestors satisfied with various rituals. Rituals are usually costly in terms of allocative resources, since they entail the slaughtering of a goat or even a cow. Similarly, the consulting of a sangoma to help sort out a problem with the ancestors is financially a costly exercise. A common belief related habit is syncretism, where people participate in ancestral rituals at the same time as attending a Christian church. Some of the larger churches active in the area, such as the Zionist Christian Church and the Shembe church, allow for this practice while the mission church does not (Respondent4). Most Zulu people "*like churches that are not strict about forsaking ancestor worship*" (Respondent7). Further, an increasing number of Zulus, in particular the more educated, regard ancestral rituals as a cultural practice rather than a belief system (Respondent5).

The traditional age/gender stratification, rooted among others in the amabutho system described in Chapter 8, implies respect for older people in the hierarchy. Females do not have the same social standing as males. "*Women have no social power whatsoever*" (Respondent5). In social and even in traditional family settings, the males, females and children remain separate; they eat and socialise separately. Each group of youths of a particular age grouping is socially educated by the group that is one level older.

Education can be regarded as an authoritative resource (Giddens, 1984: 261). According to the 2001 census, 68% of adults in Msinga have received no education at all (Statistics South Africa, 2001; Section 8.2 of this study). Since almost all children of school going age have been attending school in recent years (Respondent2), this percentage is on the decrease, and the authoritative resource is accordingly increasing up to secondary school level. There are no opportunities for tertiary education within the boundaries of Msinga (Respondent1). Although the increase in education levels is encouraging, it does not necessarily lead to increased employment. "*So many matriculants… are walking around here. Maybe they had good results for matric but they can't go anywhere*" (Respondent1). The fact that the younger members of the community are on average better educated than older generations, provide them with an authoritative resource that comes in conflict with the traditional authority base. At the same time, the older generation acknowledges the value of education and are keen that their children are educated (Respondent4).

9.5.1.4 Normative rules

The most important traditional Zulu value is respect (Respondent8, Respondent7, Respondent5, Respondent3, Respondent4, Respondent6). One needs to respect one's elders and one's own parents. Respect is shown in social practices, in the way one addresses older people with appropriate gestures and words. Unfortunately, unconditional respect has in recent years diminished (Respondent4, Respondent5). A possible explanation for this is that the younger generation have increasingly been going to school as explained above, and are thus equipped with a new knowledge base (authoritative resource). They do not respect older people who are illiterate, who have traditional knowledge about aspects like grazing and who know nothing about technology or the subjects taught at school. Younger people "*do not want to walk barefoot after cattle*" (Respondent4) – they do not have respect for the traditional ways. Another explanation for loss of traditional forms of respect is that many children do not grow up in a traditional family setting any more, because of HIV/AIDS, the historical impact of migrant labour and fewer couples getting married (Respondent5).

Another defining Zulu value is that of mutual caring. Another term for it is ubuntu: I am, because we are. The community's well-being is more important than that of an individual family (Respondent4). According to Respondent4, this value has helped the Zulu community in the past through hard times. In general, people will not walk past you without stopping and enquiring after your family, work, health and so on; Respondent4 gives this as an example that people genuinely care for each other.

Traditionally, the behaviour between young men and women is guided by normative rules. Young women are taught that "*they must not mess around with boys*" (Respondent3, Respondent8). According to Respondent3, this value is the most important defining Zulu value apart from respect. Females are expected to keep themselves chaste until they have agreed to become the wife of a particular suitor. The whole traditional courting process involves the acting out of well defined social roles.

9.5.1.5 Rituals and social practices

Traditional Zulu rituals are often related to significant stages in a person's lifespan. Often, these rituals are connected to ancestral worship. Rituals already begin with child birth, and they continue up to a person's funeral.

When a mother is giving birth, her female companions run around the hut and call to the ancestors to help the woman who gives birth. A year after the baby is born, a feast is held during which the ancestors' blessing is evoked on the baby. Everyone present receives a piece of the skin of the cow or ox that was slaughtered for the occasion. At the youth's coming of age, a feast is arranged to celebrate it, with the double intention of informing the community that the young person is ready to get married. Male suitors are only allowed to court women at a distance, often through messengers, until the woman agrees to get married. The lobola negotiation process that follows is an intricate one that involves the extended families, in particular the adult males, of both the young man and woman. If a person dies, relatives visit the site where the person died to fetch the spirit of the deceased. A candle is lit and kept burning during the journey back, representing the deceased's spirit. The funeral is a large event that involves the entire neighbourhood, during which the deceased's family is expected to slaughter a cow or ox and provide food to everyone attending (Respondent5, Respondent6).

During a visit to a Zulu household, the researcher observed artefacts which were pointed out to her as symbols of ancestral worship: goat skins hanging from the roof, and bones stuck in the thatch of the roof above the door.

The above mentioned rituals and practices are only a selection of those associated with Zulu culture. Whether these rituals form part of serious ancestral worship or are performed in a more secular way, they are important social and communicative events, indicative of a social identity.

9.5.2 Autopoiesis concepts

9.5.2.1 Organisation

The Zulu identity is characterised by the tribal leadership system and land ownership system, ancestral worship, respect, ubuntu, the inability of the subsistence livelihood system to move people out of survivalist mode, a weak fit between the traditional and capitalist value systems, and economic dependence on externally instated social welfare grants. There is an internal tension between traditional culture and progression according to the values of western society.

9.5.2.2 Organisational closure

The Zulu social structure (which is its organisation, from an autopoiesis perspective) has largely remained in place and is clearly observable during social practices. On the one hand,

the permanence of this structure can be ascribed to a strong sense of social identity that is maintained. On the other hand, it could be ascribed to the geographical, social and economic isolation of Zulus under the tribal land system.

9.5.2.3 Drift

The "*influence of the western lifestyle, and the focus on education and material advancement*", as opposed to "*being together, being part of the community, to have gatherings, to talk, to sing*" – these changes are experienced as traumatic to the Zulu community (Respondent4). Although progress is seen as being necessary and good, older people observe the results of these influences such as the diminishing respect for age, and find it difficult to interpret. Respondent4 wishes that people could be better facilitated through the process of change.

9.5.2.4 Structural coupling

The Zulu tribal leadership needs to interface with South African government organs. It appears that where such interfacing is done with mutual respect and with the interest of the Zulu community at heart, the structural coupling is successful. An example is the recent establishment of joint decision-making structures between tribal leaders and the South African government.

Structural coupling between Zulus at individual or household level and social systems outside their own, occur with mixed levels of success. The entire Zulu community is meant to benefit from a functional education and health care system instated by national and provincial government from outside the community. However, the education received is not necessarily enough to become employable in the formal sector. The 80% portion of the community that is very poor is not in a good situation to interface with the 'outside' world. For example, they do not necessarily have the knowledge or means to apply for the social grants that they qualify for. The 20% that is relatively more affluent are in a better position to interface, since they are literate, able to speak English, have a means of transport and so on.

9.5.3 Sustainability

In its current state, the Zulu social system does not appear to be economically sustainable. The historic context of this situation is given in Chapter 8, and the current factors that systemically influence the economic situation are discussed under the allocative resources section above.

Socially, some characteristics of the system contribute to sustainability and others not. The concept of caring, or ubuntu, contributes to sustain the system. However, the unequal relationship between males and females does not help to improve the socio-economic situation of females and also contributes to the spreading of HIV. Changes to the life world of the Zulus have led to a breaking down of traditional values and social structures which used to provide stability to the community. The individualist values that underlie capitalism do not combine well with the social identity of the community. Zulu traditions and social practices have largely remained intact despite the fast-changing environment. While the researcher initially interpreted the continuation of these vivid traditions as evidence of a successfully self-producing social system, she increasingly came to the conclusion that they may have remained intact to such a large extent because of the geographical, social and economical isolation of the community.

9.6 Description of system served: the mission system

The Tugela Ferry mission is a serving system of the Zulus, while it is a system served by the ICT4D project. As such, it has an important interfacing role. The mission is characterised by an uncompromising Christian faith. In the past decades they have established institutions which have become benchmarks of caring as well as socio-economic development: an orphan care centre, a medical centre and the mission school. The mission's social structure is discussed below, followed by a description of the mutual influences between the mission and the traditional Zulu social systems.

The mission is described as a separate social system because it has characteristics that clearly distinguish it from the traditional Zulu system. However, the vast majority of mission workers and congregation members are Zulu speaking. These people have left behind some aspects of their Zulu identity and retained others, as discussed below. The mission and Zulu systems are distinguished for purposes of analysis, as indicated in the assumptions section in Chapter 8. They are differentiated by key aspects of their social structure and social practices.

9.6.1 A structurational view

9.6.1.1 Interpretive rules

Everyday situations are interpreted by this community through the lens of Christian faith. For example, it has been difficult for the community to make sense of the many AIDS-related

deaths in recent years. However, they turn to God for hope and comfort: "*God has a reason*" (Respondent3). People are encouraged to read the Bible themselves, and interpretation of scripture is facilitated by the pastors rather than being done on behalf of congregation members (Respondent5, Respondent6).

The mission accommodates the Zulu social identity. Every church group that meets regularly, such as the youth, young couples and the ladies' group, has its own choir and a substantial part of their weekly gatherings is taken up by singing together (Respondent6). Music has traditionally been an important part of Zulu social life (Magubane, 1998: 62), and singing together is a significant activity.

9.6.1.2 Allocative resources

One of the characteristics of the mission is its ability to source external funding for projects and for some of its institutions. The medical centre is doing medical research in the rural community in collaboration with two American universities and as a result they receive research funding that assists them to provide medical services. The orphan care centre has received funding from the World Health Organisation's Global Fund to set up infrastructure and new projects. The church is linked with other faith-based institutions, predominantly in Germany but also in the United States. They are also networked with some churches and institutions in South Africa. The faith-based institutions assist, for example, by sponsoring needy children to attend the mission school or by sending volunteers to help with particular projects. A few farms and organisations in the neighbouring vicinity donate food, which is used towards the monthly food parcels for families who have orphans in foster care. The mission has also instituted its own income-generating initiatives, such as a local bakery and restaurant. According to Respondent4, the mission's ability to source and manage external funding for socio-economic development projects differentiates them from neighbouring Christian churches, who do not have the means to take on similar projects.

The mission's infrastructure and facilities are very valuable to them in the execution of their activities. The mission has a campus that is within walking distance from the Tugela Ferry town centre. The site contains the main church building, housing facilities, a kitchen, the school building and bakery, as well as store-rooms and offices. These buildings have symbolic value to the members of satellite branches, who usually gather in more humble buildings or even under a tree in a remote location. To them, the main church buildings signify that they "*belong to a church that is prominent*" and has a "*visible presence*" in the community

(Respondent4). The housing facilities of the mission allow them to receive visitors from time to time, usually volunteer workers or people attending a church conference.

The hospice at the medical centre takes in people who are terminally ill, the majority of whom are rehabilitated and able to return home although required to take chronic medication, such as antiretrovirals. The building has been designed with health principles in mind, having very large windows and good ventilation (Respondent5). The windows allow in a lot of sunlight as the ultraviolet rays kill tuberculosis germs. The orphan care centre has day care facilities, accommodation facilities for orphans and vulnerable children (OVCs) who cannot be placed in foster care, as well as accommodation facilities for care-givers. The building where the mission school is housed has a separate room for each grade, even though the rooms are small. Preschool children are housed on separate premises. The school uses the church as a school hall. There is open space for school children to play but no sports fields. The school has a computer centre containing 12 networked personal computers. This facility, together with the mission's accommodation facilities, enabled the ICT4D project team to present IT literacy courses at the mission site.

It needs to be noted that there are government schools as well as government health services distributed through the Msinga municipality. The mission's medical centre focuses on services that supplement government primary health care, for example the hospice. The school differentiates itself by providing education for congregation families who wish for their children to have quality education taught along with Christian values (Lobza Gazette, 2009: 4). The fact that the mission school's academic performance significantly exceeds that of other schools in the district, as discussed in Chapter 8, is one measure of the relative value it adds to mission families.

9.6.1.3 Authoritative resources

According the Christian faith, God is the ultimate source of power. When faced with a challenge, people pray about it (Respondent3, Respondent7). "*We live by faith, I can tell you*" (Respondent3).

The authority structure of the mission appears to be democratic; there is no one person in the church that has absolute power. The church has a committee of elders that jointly take decisions (Respondent6). It does not appear that people's position in church, such as being an elder, is a significant source of status, although people in official positions are respected.

The mission's institutions provide authoritative resources, in the form of knowledge and education. The knowledge possessed by the leading figures at each institution is transferred to mission personnel and to the respective communities they serve as far as possible. At the school, children are not only taught the school syllabus. Teachers take an effort to transfer practical knowledge about dietary habits, personal hygiene, good housekeeping and planning ahead for events (Respondent6). At the orphan care centre, care-givers and foster families receive guidance on the physical, emotional, nutritional and medical care of orphans. Social workers at the medical centre take care to assist people to generally improve their livelihoods. For example, the researcher observed during a field trip that a family receiving social welfare assistance was also helped to start a vegetable patch. Nursing volunteers from the medical centre assist remote patients in taking their medication regularly and to improve living conditions, for example teaching tuberculosis patients to air their huts.

9.6.1.4 Normative rules

The mission attempts to practically embody the Christian value of caring. The orphan care centre has been established with the motive that "*Christ loved the orphans and the widows*" (Respondent3).

At the mission school, rules of conduct are laid down explicitly and strictly. The researcher found more than one set of school rules pasted up in the buildings. Girls are not allowed boyfriends while they attend school (Respondent6, Respondent5), but instead encouraged to "*keep themselves pure until marriage*" (Lobza Gazette, 2009: 3). Pregnant girls are expelled. The result is that the teenage pregnancy rate is relatively low – the result of an attempt by the school to get learners to live out Christian values. At the same time, this rule has a positive developmental impact as it encourages girls to finish their education.

Congregation members are encouraged to dress conservatively. Ladies are encouraged (rather than coerced) to wear skirts. In Zulu culture the sexual area of a woman is from her hips down to her knees, and the western habit of wearing pants and especially tight jeans imply that the sexual areas are too visible (Respondent5). Unmarried people are expected not to have intimate relationships. For a woman to have a boyfriend or to spend time alone in the company of a male always implies intimacy in this community, so the sexes are expected to socialise separately. Congregation members are expected not to eat meat presented at a traditional funeral, since the meat has been offered to the ancestors (Respondent5). They are expected to completely break from ancestral practices, even if these are practiced in a cultural

rather than religious context. The church believes that ancestral practices may be demonic (Respondent4) and that it weakens the church, collectively and individually, if syncretism is practised (Respondent6).

The church leadership is expected to set the example in living out the church's strict value system. In this community, there are no secrets; it will soon be known if someone preaches one message and lives out another. Since the practical living out of their values was experienced to be of greater impact than what is preached, this point is taken very seriously by the mission church. Living an impeccable life is "*very costly*" and requires "*a lot of discipline*" (Respondent3).

The mission shares with the traditional Zulu system an emphasis on respect (Respondent3). However, this notion of respect does not imply the same degree of inequality, for example between genders. The mission encourages, as an alternative to the strict age/gender hierarchy of traditional Zulu culture, a more equal treatment of females and tighter social relationships within the nuclear family: between husband and wife and particularly between fathers and their children (Respondent6). However, the traditional Zulu influence is visible and accommodated by the church as long as it is not perceived to be destructive. For example, during the church services the ages and genders are roughly separated. On the one side of the church, the elder men sit in front, followed by adult men and with the male youth behind them. On the other side of the church, females sit in the same order.

9.6.1.5 Rituals and social practices

Regular activities at the church include the weekly worship services on Sunday mornings and prayer meetings on Wednesday evenings. There are groups that gather on a weekly basis, such as the high school youth, the working youth, young couples and women's group (Respondent6). Important seasonal rituals on the church calendar are Easter and Christmas (Respondent7). Rituals related to stages in a person's life are much fewer than in traditional Zulu culture. The male-female courting ritual involves the head pastor as mediator between the male suitor and the woman. A brides-gift may still be payable. The wedding ceremony is at the church. Funerals also involve a church service, but burying ceremonies are not as extensive as the ones involving ancestral rituals.

All meetings held at the mission are opened with a prayer, even if meetings are not directly church-related. When the ICT4D project team did computer training, the training sessions and planning meetings were opened with a prayer by a mission member who was present.

The fact that the rituals of the church are much fewer than the rituals people have to leave behind from traditional Zulu culture, is acknowledged as a shortcoming (Respondent6). In particular, the lack of constructive recreational activities for the younger people is recognised as a shortcoming. The youth are often told what not to do, but they need something to do instead.

9.6.2 Autopoiesis concepts

9.6.2.1 Organisation

The mission is characterised as a faith-based organisation which aims to convert people to the Christian faith. One of their most important ways of doing this, is to try and practically make a difference in the lives of the Zulu people, many of whom suffer from extreme poverty, illness and dire social circumstances. The mission institutions are each dependent on a few key individuals in leadership roles who have dedicated their lives to the church and its causes.

9.6.2.2 Drift

The mission has, in the decades since it started as a satellite branch of another mission and through its independence just over 10 years ago, successfully established itself alongside the Zulu social system. However, their position cannot be seen as comfortable or even stable. Financially, they are continually struggling to break even. Although sources of income are uncertain they make an effort to sustain their aid projects. The church leadership appears to be open to messages from God to take on new initiatives or to change the way in which they are working. Thus, the “drift” is to where they perceive God is leading them.

9.6.2.3 Organisational closure

The mission church pro-actively creates a boundary of difference and distinction by the clear value system that members are expected to live in practice. Congregation members are expected to clearly set themselves apart, particularly where it concerns male-female relationships and ancestral practices.

9.6.2.4 Structural coupling

The mission has learned to live within and alongside the traditional Zulu community in a peaceful manner. There is a clear mutual respect between the two systems. The Zulu people interviewed who were not part of the mission congregation, were positive about the mission's presence (e.g. Respondent2).

The mission shows the ability to successfully interface with external donors, something which has assisted them to develop and grow their institutions, and to make a significant developmental impact within the Zulu social system. They are also able to interface with government institutions, such as the Department of Social Welfare and Home Affairs, to assist needy families to apply for social grants, or with Department of Justice to place orphans with foster families. The mission school interfaces with tertiary education institutions, arranging for example an annual visit to South African universities, and helping matriculants to apply for university bursaries.

9.6.3 Sustainability

In the case of the mission, it can be clearly seen how its continued self-producing organisation, its organisational closure as well as the success of its structural coupling with several neighbouring social systems, has contributed to its relative sustainability.

9.7 Mutual influences: Zulu and mission systems

In this section, the mutual influences between the Zulu and mission systems are described. While the researcher's primary concern is the influence of the mission system on the Zulus, there is a reciprocal influence. Some general system related matters that arise from the systems descriptions are subsequently discussed.

9.7.1 Using the systems framework to describe mutual influences

The mission shares with the Zulu system its key traditional values of caring (ubuntu), respect and male/female chastity. The practical displaying of caring has significantly helped the mission's social acceptance in the broader community. As mentioned, the mission over time has realised that their scriptural message has a much larger impact through their deeds than through their words (Respondent3). The traditional Zulu value of respect is re-presented by the mission as a reciprocal one: males and females must respect each other, not just the one

way round. The mission shares the traditional Zulu value of chastity: that young males and females must keep separate until their intention to marry becomes official (Respondent3). From the above, it can be seen how the mission has successfully applied some important traditional values of the Zulu social system in order to gain acceptance in the Zulu community, and in other cases redefined traditional Zulu values such as respect, in order to work towards a more sustainable social arrangement.

The tribal leadership of the Zulus is recognised by the mission as authoritative resource. The blessing of the tribal leadership is sought in any new endeavours of the mission. For example, if a pastor wants to enter a new area to preach there, he first talks to the Induna who oversees tribal matters in that area (Respondent4). At the same time, the Zulu community has learnt to respect the authority of the mission and its institutions. People can see for themselves what happens if a sick person goes to the mission's medical centre, compared to a sick person that visits the sangoma or herbal doctor. Also, people who are not members of the church will go to the head pastor for advice on social matters (Respondent3). It can hence be seen how the mutual respect between the two social systems help them co-exist in a constructive manner.

The mission aims to provide the Christian faith as an alternative sense-making scheme (as well as authoritative resource) to ancestral belief. People have to forsake ancestral rites when they join the mission church. This is done in a peaceful manner so as to discourage conflict, although it may result in conflict. Conflict occurs when some members of a family, or families in a community, join the church and refuse to participate in ancestral rites. Such people may be ostracised by their traditional Zulu community. However, it appears that related incidences of violence are the exception rather than the norm. Women often convert to Christianity more easily, having very little to lose by forsaking traditional Zulu culture, while for a male his traditional social status is negatively affected (Respondent4).

The allocative resources that the mission has brought into the community have enabled them to successfully assist with socio-economic development in the Zulu community. The Zulu tribal leadership has availed the Zulu allocative resource of land to the mission, without which the mission would not be able to operate in tribal area.

The mission provides the authoritative resource of education, together with a value system that enables learners to negotiate between this new source of authority, their traditional Zulu background as well as the western society.

People working full time for the mission experience a spiritual meaning in their lives, because they are able to live out their calling, but also because of the goodwill and ubuntu that they experience among the Zulus. They give their lives to the community, and are looked after by the same community: "*I do not have a pension. The community has been looking after me since I came here and I know they will continue to do so*" (Respondent5).

Using the terminology of autopoiesis, the mission can be said to mediate structural coupling between the Zulus to whom they provide services, and between other institutions. For example, they mediate structural coupling between school learners and universities, and between people that can benefit from government grants and services, and the institutions providing those services. For members of the church, the mission provides a value system with boundaries, contributing to organisational closure for people who are part of the mission system.

The mission contributes to the improved sustainability of the Zulu system. The mission assists in providing allocative as well as authoritative resources to the broader Zulu community, thereby empowering people to better sustain themselves. "*As the need and distress in the community increased, the mission became more of a resource, and in the process grew closer to the Zulu community*" (Respondent5). The social "us" and "them" boundary of the past has diminished as Christian people became known for their willingness to help anyone in need (Respondent5).

Many core Zulu values are respected by the mission, including caring/ubuntu, respect and chastity, as well as a collectivist culture. For Zulus who want to join the mission, some normative and interpretive rules are replaced by a Christian outlook and values. The mission assists all people in the community, not only members of the church, to better interface with service providers and external institutions. This interfacing or structural coupling strengthens the Zulu system. Since the mission is small compared to the Zulu social system, the mission's impact on socio-economic development is qualitative rather than quantitative.

The above discussion indicates how the concepts of the systems framework can be used to describe the mutual influence between the Zulu and mission systems. It can be used to explain the success of the mission in establishing themselves in the community. The concepts of the framework also indicate how the mission's endeavours potentially contribute to socio-economic development and the systemic sustainability of the Zulu social system. The latter conclusion is of vital importance to the ICT4D project. The interest of the ICT4D project is

the socio-economic development and sustainability of the larger Zulu community, who the ICT4D project team do not have direct access to. If it can be shown that the ICT4D project strengthens the mission's ability to deliver services to the Zulu social system, then it can be claimed that they indirectly contribute to the development and sustainability of the larger Zulu community in Msinga. This point is revisited when describing the influences between the ICT4D project (serving system) and the mission system in sections that follow.

9.7.2 Some general system-related matters

From a systems point of view, helping people to apply for social welfare grants and to obtain antiretrovirals is not a sufficiently systemic way to address the problems of the Zulu social system. These are short term solutions that help people remain alive but that do not necessarily address the causes of the symptoms. Improving people's education, not only in terms of formal schooling but in terms of the practical knowledge discussed earlier, is a more systemic solution. Providing people with a value system that includes mutual respect between males and females as well as sexual morality, is also a systemic way to deal with the problems presented.

Also of systemic relevance, is that the mission appears to be, in terms of its purely religious services, equally involved with the relatively affluent 20% of the Zulu community and in the very poor 80%. The main church building is accessible to the affluent, and the congregation initially consisted mostly of the people from that group. However, the remote satellite branches have all been established in areas where the poorest sector lives (Respondent4). The caring projects of the mission are also primarily aimed towards the poorest.

The scalability of the mission's influence is a systems concern. It has been mentioned earlier that the mission is concerned with the quality of their influence in the community, rather than in numbers of people converted. The scalability of their interventions is limited. They rely on people who have experienced a spiritual calling or who are there because they want to make a difference. The teachers at the mission school receive far smaller salaries than their counterparts in neighbouring government schools. The bulk of the school's income is the school fees paid by the parents, almost all of whom can be classified as poor. At the medical centre, the professionally trained doctors, nurses and social workers receive salaries, while around 200 nursing volunteers from the community assist with the home-based care of patients in remote rural locations for no remuneration. There is a fairly high turnover of teaching and nursing staff, most of whom leave to better paying jobs. In spite of this, these

institutions manage to remain sustainable. However, they are not in a position to drastically expand. Even with more monetary resources, working in this community requires a commitment and caring attitude that cannot be bought.

"Unintended consequences" is a term used in Giddens' (1984: 5) structuration theory, as well as being part of systems terminology. An unintended consequence observed at the school, is that their outstanding academic performance, sustaining a 100% pass rate for 10 years compared to the provincial average of around 61% (Chapter 8), is putting severe pressure on the teaching staff. Teachers have to work many additional hours to meet the high expectations. It appears that this pressure, more than the small salaries, contributes to the high turnover of staff.

In the sections that follow, the next system of interest to the study is described: the ICT4D project as serving system. Such a description will enable the assessment of mutual influences between the serving system and its systems served, in order to see whether the serving system contributes to the development and sustainability of the systems served, which is the ultimate aim of the study.

9.8 Description of the serving system

The intention of the ICT4D project is to effect socio-economic development in the broader Zulu community, by means of IT literacy training. It started off as a serving system to the mission, which has been its main emphasis to date. However, it has also resulted in initiatives which are aimed at serving the broader Zulu social system. The section below is mainly written from the researcher's point of view, as a member of the serving system, while it is supplemented with data obtained through interviewing her own colleagues.

Along with the particular ICT4D team come a set of interpretive and normative rules which they have inherited from a western education, and from the global IS community that they form part of. The values that they bring along collectively if not individually, include an adaptability to rapid technological change, a view of technological progress as being good, a view of time as being precious and tightly measured and where people are expected to be available around the clock, a view of space as being virtual as technology makes distant locations and events more accessible, and a task-oriented focus that places a high value on efficiency and effectiveness. They bring along assumptions of capitalism, which values the ability to respond to market needs and integrate into the larger economic system, in order to

generate surplus income that contributes to the accumulating of individual wealth. They come from a global world with a secular, blended set of norms that accommodate and tolerate different cultures and religions, and where ethics is a dynamic concept that evolves as technology enables new social situations, such as with social networking.

Within the broad set of assumptions and views sketched above the ICT4D research community, as a subset of the IS research community, can be classified into different streams of thinking. Each stream of thinking is characterised by its own set of beliefs and assumptions. The stream of thinking that this particular ICT4D team most closely aligns with is the "social embeddedness" stream (Avgerou, 2009: 12). It assumes that ICT has the potential to improve the socio-economic conditions where it is implemented, but the manner in which it is implemented must be "locally decided". Local people should decide for themselves what their development goals are, and the way ICT contributes to these goals must be the result of local improvisation.

The description of the serving system that follows is primarily based on empirically collected information related to the immediate context. While describing the social structure of the particular ICT4D team, an attempt is made to remain cognisant of the larger set of values that they convey, consciously or subconsciously. Since the main activity of the ICT4D team, as serving system, involved interaction with the mission system served, the description that follows discusses this interaction and provides provisional reflection on it.

9.8.1 A structurational view

9.8.1.1 Interpretive rules

The main sense-making scheme that characterised the ICT4D team was that of rationality. 'Rationality' refers here to a means-end way of reasoning that goes beyond practical rationality to include theoretical rationality (Kalberg, 1980:1152). The university team came with academic and technical knowledge, and possessed reasoning skills that were acquired in the university and western work environment. When confronted with a challenge, they tend to debate and reason about it, and consider the various angles of the matter. This researcher found the difference between her own rational outlook and that of the local people in Tugela Ferry at times frustrating. "*During interviews and conversations, I ask people about facts and details, and often struggle to get it…. the people here do not think in terms of facts, statistics and analysis. Those things do not matter to them. What matters, is more the essence of what is*

happening, and to be part of the social activities… these people prefer to tell stories" (Turpin, 2010).

The ICT4D team set it as their goal to make sense of particularly the Zulu culture, values and sense-making schemes. The mission sense-making schemes were more "available" to the team, since all of them at some stage participated in a Christian faith, whether reformed, orthodox or catholic. The ICT4D team itself was multicultural, at one stage consisting of 5 team members originating from 4 African countries: South Africa, Kenya, Ethiopia and Eritrea. They shared an interest in learning about other cultures, including each other's cultures. All were fluent in English, two were fluent in Afrikaans and one was fluent in Zulu. English was the lingua franca that helped them to interact with each other and with the Tugela Ferry community. However, the knowledge of Afrikaans and Zulu assisted team members to establish communication of a more personal nature within the case setting, since some of the mission workers were Afrikaans speaking and almost everyone else in the community had Zulu as their home language.

The rational sense-making scheme that characterised the ICT4D team was embedded in the technology and software that course attendants needed to learn. Overall, it was found that course attendants who have had longer exposure to practical and perhaps theoretical rationality, such as those who have recently completed their schooling at the mission school, or who was studying for a diploma, found the software and technology less intimidating. The spreadsheet software was perceived to be the most challenging to the course attendants overall. Care was taken to use practice examples from their own environment during class exercises. Respondent9 found that one could not generalise about course attendants: for example, one elderly man who probably did not grow up with proper schooling was the fastest to grasp the spreadsheet concepts.

Once the ICT4D team started to understand the practical implications of the Zulu collectivist identity (as an interpretive rule of the Zulu social system, also characterising Zulus involved with the mission), they started using it to the benefit of the training. It was found that people progressed better through the course material when they could work together and explain the work to each other. While facilitating a train-the-trainer session, Respondent9 observed that the Zulu course presenter initially tried to emulate Respondent9's own way of presenting. He asked the woman to do it in her own way, and observed how she relaxed while a spontaneous to-and-fro chatter emerged between the presenter and the class. According to Respondent9, they were busy with a collective sense-making exercise, and were working to reach common

agreement in the group. Respondent9 also realised that establishing a social rapport with the group during breaks made a big difference when teaching; it was important to the group to be socially recognised by him and to be able to relate to him. Assessments had to be done on an individual basis. It was observed by the researcher that the course attendants found this to be very stressful, even though they were able to complete the assessments successfully on their own.

The ICT4D team's ability to grasp something of the interpretive, social sense-making rules of the course attendants was witnessed by both course presenters interviewed (Respondent9, Respondent10) as a communication breakthrough, which assisted not only in the successful conveying of IT concepts but also resulted in training that was better grounded in the social structure of the mission system served.

9.8.1.2 Allocative resources

The project was able secure funding from the University of Pretoria as well as UNESCO, which helped to pay for expenses related to training courses presented in 2009 and 2010. Without this funding, it would not have been possible to initiate the project. The mission assisted with allocative resources in the form of accommodation, subsidised meals and making available the school's computer studies classroom originally equipped with 10 computers.

The team was able to bring along equipment and training materials printed at the university. Equipment that facilitated the training included a data projector as well as desktop software to ensure that all the personal computers were ready to be used for training. Some of the teachers and mission members who attended the training brought along their own laptops, so as to allow more people to be trained in the same venue. During the period of involvement, the ICT4D team helped to maintain as well as supplement the computer hardware at the school, so that they currently have 12 working computers.

The local businessman who took the initiative to start a training centre in Tugela Ferry (see section 8.7.3.5) invested substantially in renting and equipping a room and the purchasing of personal computers and software. For the courses presented at this centre, community members paid course fees to cover the costs incurred. The courses were established with the ICT4D team's facilitation, but were presented by local trainers.

The ICT4D team's ability to utilise what allocative resources were available at the mission school, to improvise with equipment, to source funding from their own institution as well as from a third party, combined with the resources contributed by individuals and at institutional level by the mission, all assisted to enable the IT training. The fact that all parties contributed resulted in joint ownership of the resource base, which was important in the collectivist culture setting. Apart from the ICT4D team's strengthening the allocative resource base at the mission, the utilisation of allocative resources led to the enhancing of authoritative resources, as discussed below.

9.8.1.3 Authoritative resources

The authoritative resources brought by the ICT4D team that was of direct relevance to the project, was their knowledge and experience in teaching IT literacy courses, technical know-how to fix hardware and software problems, to set up a network and to install relevant software.

The ICT4D team had an implicit social status, being associated with the university. This appeared to be especially pronounced in a rural community where tertiary education is not readily available. Further, the official certification of the IT training by the University of Pretoria carried significant weight with course attendants.

The ICT4D team presented the first series of courses in response to a request from the mission, at the mission premises. As such, the broader community associated them with the mission, when they walked in the street or interfaced elsewhere with the community. Missionaries are perceived to have a certain authority and local people have a high level of respect for the work of the mission, which meant that the ICT4D team inherited some of the mission's respect and authority base. At the same time, the ICT4D team leader made an effort to arrange meetings with the main pastor of the mission, as well as with the Zulu tribal chief, in order to introduce himself and to get their respective blessings for the work undertaken. The ICT4D team's recognition of local authority bases helped the project to run smoothly.

The fact that mission staff did not have to pay for the courses presented at the school appeared to reduce the intrinsic value and status of the course. People did not attach a high value to a course that was "for free". This matter was raised by local representatives during a planning meeting in June 2009, before the first course commenced. It was decided to communicate to course attendants the actual cost per attendant of presenting the course. The actual cost was

high and in the same order of magnitude as what was charged elsewhere in the region for computer literacy courses. In doing so, the ICT4D team succeeded in managing perceptions as to the value of the course.

Another aspect that affected the perceived value (and authoritative status) of the course was its time duration. During a later series of courses presented by newly trained local trainers, course attendants compared the time period over which the course was presented with the duration of another computer literacy course presented in the region. The material covered was similar in content, but the university's course was presented over a shorter period. While the ICT4D team was proud of such efficiency, a shorter course was perceived by the local community to have less value and status (Respondent9). This was a problem for the ICT4D team because they were pressed to deliver, and stretching out the training had cost implications.

Overall, in terms of authoritative resources, the ICT4D team's perceived authority, being associated with the university, was significant. This perception was over and above the actual authoritative resources they contributed in the form of skills. In addition, the broader Zulu community associated the ICT4D team with the mission, the latter which in itself had local authoritative status. The ICT4D team made an effort to acknowledge the sources of authority of both mission and Zulu systems, which assisted their smooth interaction with the community. The perceived authority of the course they presented benefited from its university association but to an extent suffered in status because it was presented "for free", and at a later stage because of its short duration.

To assess the ICT4D team's contribution to the authoritative resource bases of the mission as well as the Zulu system served, one would have to go beyond the number of people trained or enrolled for training (just over 80 by October 2011), to see whether and how the new skills have been enacted to become authoritative resources in the community. Evidence of enactment is discussed in the general assessment of the influence of the serving system, in a following section.

9.8.1.4 Normative rules

A value that was shared among the ICT4D team was their keenness to make a difference, by becoming practically involved in the community through teaching, and by means of their research. Another value brought along from the university was academic integrity. When

doing training and assessments, the trainers had to ensure that course attendants had been reasonably equipped to pass the assessments. Assessment had to be to a previously agreed standard since it carried the university's name.

Before the first training commenced, the ICT4D team was told by the mission liaison that the people attending the course required firm ground rules. The team was requested by the liaison to type up the rules of the course (such as starting times), paste it visibly on the wall of the training centre and discuss it at the onset of the course. This matter was stressed to be very important.

In general, during field visits, the ICT4D team adopted the normative values of the mission. They tried to enact the values of caring and respect. These were also assumed of them in practice. For example, one of the mission's ways of showing their care is to give pedestrians lifts in their cars (few local people have their own transport and public transport is not always accessible). It is generally known that a local person can stop a mission vehicle if there is still space inside, and request to drive along. During one of the field trips, this researcher was asked if she was willing to take two students back home in her car and drop them in Johannesburg. Having been able to fulfil the request was confirmation of her association with the mission.

The ICT4D team also tried to acknowledge Zulu norms and work along with these. Ways of showing respect during greetings and social interactions were attempted. For example, when the ICT4D project leader went to meet the tribal chief, he bowed his head while he was talking and looked to the ground, this being the way one should address the chief. Within the Zulu social structure, people socialise easily with the same gender but not with the opposite gender. It was found that the ICT4D project leader, being a male, could more readily interact with Zulu speaking males and also collect data more easily from males during conversations. Similarly, this researcher, being female, found that traditional Zulu females readily warmed to her, even though she barely knew them. Zulu males were far more distant with her, except when they held a professional position and she went to see them in a professional capacity, usually in their offices.

A difference in normative rules that the ICT4D team had to learn to deal with was between their own task-oriented approach and the local people's people-oriented approach. The ICT4D team valued the efficient and effective completing of tasks, and assumed the goal of many social interactions was the successful completion of a joint task, with the focus on the task

rather than the other people. In contrast, the local project champions as well as course attendants wanted confirmation that they were valued as people before committing to complete a task. The ICT4D team had to slow their pace at the onset of a new task, to spend time showing personal interest in the individuals involved and make sure everyone present received a chance to talk (Respondent10). At the same time, the local champions setting up the computer training centre benefitted from learning to be more task-oriented. In this case, they had to learn to value the timely completion of a training module, at the cost of always pleasing course attendants (Respondent10).

The ICT4D team members who did research had their personal research ethics as normative rules. The vulnerability of the Tugela Ferry community required ethical sensitivity beyond what is usually included in the university's formal ethical clearance process and guidelines. Research respondents were trusting and not in a position to protect themselves if they were to be exploited. Among them were people who were illiterate and could not speak English. Special measures had to be taken to obtain informed consent in such cases. Although it was possible to obtain verbal informed consent through a translator and record the conversation, respondents were willing to sign their names on a form if the contents were explained to them in Zulu by a person they trusted. Empirical summaries, descriptions and analyses were confirmed with literate people from the community who acted as cultural interpreters as well as community gatekeepers. In one such case, a research output based on empirically obtained information had to be revised because the matter was considered to be too sensitive to document.

To conclude: the ICT4D team's attempts to acknowledge the normative rules of the mission as well as the Zulu systems helped to legitimise their initiative. At times, they had to negotiate differences between the values associated with the IT training and the local values, for example between task-oriented and people-oriented values, in order to achieve training objectives while acting in a socially legitimate way.

9.8.1.5 Rituals and social practises

Since the first reconnaissance visit to Tugela Ferry, during which contacts were established at the various mission institutions, the ICT4D project leader made a habit of regularly contacting key people at the mission. These were the people who had to become the local project owners of an IT training initiative. As discussed in section 8.7.3, the ICT4D team had to wait for a

local person with authority to invite them to do the training. The regular social telephone conversations eventually paid off and he was invited to present training courses.

Since 2009, it has become a social practice for the University of Pretoria to receive and host the Grade 11 learners of the mission school during their annual visit to universities. Learners and their teachers are accompanied through the university campus, information sessions are organised at the different faculties, and accommodation is provided for the group. Two members of the ICT4D team have each time assisted in hosting a few learners at their homes. This researcher experienced the intercultural exposure as meaningful to all parties involved, especially to her own children. The ICT4D project leader has taken the social interaction to a next level by inviting contacts at the mission to come and visit and stay over at his home in Pretoria. To date, a few people have taken up the offer. The visitors, being Zulu speaking and having a collectivist identity, could in this way start including the ICT4D project leader in the "us" of their identity. An example of such inclusion was when the headmistress at the mission school started calling him "my son". Another example was that when the ICT4D team first arrived at the mission during their July 2010 trip, a senior person at the mission said: finally, all the visitors have left! The project leader told her that the ICT4D team were also visitors, to which she responded that they were not visitors, they were "part of us" (Respondent10).

As mentioned in Chapter 8, the ICT4D team as a whole frequently socialised with members of the mission congregation while visiting in Tugela Ferry. At times, the team was invited together to dinner at someone's house. At other times, people individually visited with mission members whose company they enjoyed, or who could assist them in informal conversations with their data collection. Mutual participation in practising hospitality, in Tugela Ferry as well as in Pretoria, was an important factor in the social acceptance of the ICT4D team (Respondent10).

While visiting in Tugela Ferry, the ICT4D team took on some of the mission's social practices. Joint meetings with mission staff were opened with prayer. Women wore loose-fitting long skirts similar to female mission staff. Males and females were accommodated separately. The ICT4D team members attended the mission's church services, usually the prayer meeting on Wednesday evenings.

In conclusion, the practising of social rituals, including reciprocal hospitality, played a central role in the ICT4D team's becoming accepted by their mission hosts. The ICT4D project

benefitted from the team's being perceived as "part of us" by the mission, while on a personal level they benefitted from meaningful intercultural experiences.

9.8.2 Autopoiesis concepts

9.8.2.1 Organisation

The serving system is a small team of university staff characterised and distinguished by their technological and academic knowledge. They have joint goals of wanting to successfully transfer IT skills and establish a sustainable training facility in Tugela Ferry, as a means to socio-economic development. In the process, they want to obtain research results. As such, they are a goal-oriented system.

9.8.2.2 Organisational closure

The ICT4D team consistently acted out their identifying characteristics as presented above. This assisted them in becoming a social system in its own right – a serving system.

Secondly, they were able to take on some of the key identifying characteristics of the mission social system and to become socially accepted by the mission, to the extent that they could be regarded as part of the mission system. This internalisation enabled them to contribute to the systemic strengthening of the social structure of the mission from within.

9.8.2.3 Drift

The particular ICT4D team has been active for less than three years, a short period compared to the life span of the other two social systems. During this time, the following changes could be observed. Initially, there was a keenness by team members to train people themselves. This changed to a keenness to help establish a locally managed IT training centre. During the first training presented by the ICT4D team, some conflict was experienced between different trainers on the same course, who had differing personalities as well as different opinions on presenting training material. During following courses, the ICT4D project leader was sensitised to these differences and could manage them better. Over time, the method of training was adapted to take into account the social identity of the course participants. They were encouraged to work in groups and assist one another. This method was not only more effective but also took a significant burden off the course presenter.

As mentioned above, the nature of the relationships between the ICT4D team members and the local people whom they interacted with changed over time to become more personal. This was most visible in the case of the ICT4D project leader. Overall, the drift of the ICT4D serving system was towards closer structural coupling with the mission system, as discussed below.

9.8.2.4 Structural coupling

The establishment of good interpersonal relationships between the ICT4D team and the people at the mission led to effective structural coupling with the mission as system served. The structural coupling was further strengthened by the ICT4D team's participating in mission practices, such as attending church services. The ICT4D team abided by mission normative rules and values, for example by dressing conservatively and by presenting ground rules during the training course.

Not much formal interaction with the traditional Zulu social system and the ICT4D team was required by the project. The meeting of the ICT4D project leader with the Zulu tribal chief to obtain his blessing was sufficient for the project to continue.

The ICT4D team's ability to interface with the university's management and with potential third party funding sources enabled them to achieve funding to execute the project.

The effective structural coupling of the ICT4D team with the mission system and with other institutional role-players was key to the success of the ICT4D project.

9.8.3 Sustainability

The ICT4D team does not have continued funding to remain involved in the community. They are limited by the availability of people to do training for virtually no financial reward. When people's research projects (in particular the two PhDs) are completed, their commitment to be involved may be reduced. The setting up of a local training centre that had the potential to become self-sustaining was an important goal to them.

9.9 Mutual influences: serving system and systems served

The primary interest of the discussion that follows is the influence of the serving system on the mission system as well as on the traditional Zulu social system. However, the serving system was influenced at the same time. Influences will first be described making use of the preceding descriptions by means of the systems framework. Such influences will be further substantiated with empirical evidence, where available.

9.9.1 Influence of the serving system

The analysis by means of the systems framework indicates that the serving system enhanced the authoritative resource base of the mission staff by providing them with IT skills. The IT knowledge equipped people from each mission institution to do their daily work more efficiently, or to take on new administrative responsibilities that require IT literacy. Since the mission is a serving system of the broader Zulu community, the new skills enabled them to serve their clients better.

Three teachers interviewed a year after the first training course in 2009, said that they were now using a computer to set up tests and process marks at school. One of the teachers said that he bought a computer during the first course and has since started using it for his own photo business. A member of the mission staff said that he could now use a computer to do a quotation and an invoice, as well as send email. These skills helped him in his own business In general, he believed that the computer training "*opened chances for many people*." Also, "*the people can see that the mission does something good, and not only for their own people*" (Respondent3). Someone from the orphan care centre said that she found the Excel skills especially useful. She uses it to keep track of the donor funding, and where it needs to be allocated. She also uses it for the processing of salary payments (Respondent6). A person at the mission who interacts with the teachers regularly, witnessed that the teachers were not only using their new IT skills at school:

"*People have more confidence, not only to do school related tasks, but also to do things for other people. They volunteer, to help in committees, or to type CVs for other people. It is not as if they are just typing their tests. There is immediately a wider application….since it is a social system, one person's skill is everyone's gain*" (Respondent5).

One of the key functions of the mission's medical centre is research, related to tuberculosis as well as HIV/AIDS. The medical research, in partnership with a few American universities, is of a very sophisticated nature. Information collected from patients in the field need to be in electronic format.

"*By developing the [IT] skills of the staff, the medical centre can attract more research, because they can provide more… the staff benefit in terms of exposure and knowledge, because they get drawn into the research project. But the staff also becomes more useful to the research projects, because it is not necessary to appoint external people to capture the data. It used to cost enormous amounts of money to bring in people. And then the people cannot understand Zulu, and they do not understand the hospital's filing, and they have to redo a lot of things. The people are not part of the social structure… the social structure opens all the doors to get access to information… as a result, the people that are hired to do this work is only half effective. If you can have a person who is integrated [with the social structure]… who understand the illness… and who has the [IT] skills, then everyone wins… And what you also do, is people become employable [here]. They do not have to leave to find a job*" (Respondent5).

The same impact of the IT training on the nurses as well as the research of the medical centre has been independently observed by (Respondent6).

The empirical evidence indicates that the impact of the IT skills was not limited to people's immediate jobs. Some people have small businesses to supplement their income from the mission, and the IT skills are helping them in their businesses. Other people are using their skills in their wider community involvement. In the case of the medical centre, the skills of the nurses can lead to increased efficiency with the medical research, empower the nurses to become research assistants and even help to attract more research projects.

The local training facility that has been established early in 2011 has the potential to become a significant allocative and authoritative resource to the owner, trainers and the community. Although the facility is not making a profit yet, it has the potential to do so, in which case the owner and trainers will financially benefit. The community benefits by enhancing their authoritative resource base, which is due to help them in the similar ways as it helped the mission staff, namely to do existing jobs better, in the running of their own business, and in helping other people. If the course attendants are unemployed, it may help them to find

employment. At this stage, empirical information is not yet available on the impact of the IT training on the first trainees at the local training facility.

Other concepts of the systems framework can be used to describe the influence of the serving system as follows: The allocative resource base of the mission system has been enhanced by supplementing their computer infrastructure and servicing their existing personal computers. Regarding normative rules, the academic integrity with which courses were presented, set a baseline for the presenting of further courses locally. The interpretive scheme of rationality had to be transmitted along with technology training, for example spreadsheet manipulation requires logic to be followed. This did not necessarily have much of an influence on the interpretive schemes of local people. It was found that course attendants with previous exposure to activities that required rational sense-making mastered the technology more quickly, in particular the Excel skills.

Direct and secondary beneficiaries of IT literacy training			
Teachers: • Learners • Small businesses • Wider community, informally • Wider community, via local training centre • Teachers, earning from local training centre	**Nurses:** • All patients in their care • Medical research projects • Nurses become more employable on research tasks	**OVC staff:** • Orphans and vulnerable children • Families with OVCs in foster care • Donors (more efficient book-keeping)	**Other mission staff:** • Mission administration • Small businesses • Wider community, informally

Table 9.2: Direct and secondary beneficiaries of IT literacy training

Table 9.2 indicates the people and institutions affected by the IT literacy courses presented at the mission. It is clear that not only the mission but also the wider Zulu social system benefits from the training. The wider community benefits insofar as they are direct clients of the mission projects, employees at small businesses managed by mission staff, or people of the neighbourhood being helped with small IT tasks such as having their CVs typed.

9.9.2 Influences on the ICT4D team

The ability to set up relationships to facilitate the IT training as well as the successful completion of training courses enhanced the authoritative resource base of the ICT4D team,

individually and collectively. The ICT4D team started to be viewed by university colleagues as authorities in the ICT4D field. Their personal commitment and perseverance were noticed by colleagues and respected.

Personal exposure to a rural community that was relatively unaffected by the materialist value system that dominates in an urban, western environment, and where a value system of caring was prominent, was found to be personally enriching to this researcher. Her normative as well as sense-making schemes were affected in the process. The researcher's need to make a difference through her research was rewarded when she received feedback from a stakeholder at the mission that her completed research is regarded to be a meaningful resource. A final version of her draft thesis was given to the mission contact for comment. The feedback was that she covered a rich and varied collection of perspectives, including material from which the local stakeholders could learn and that would be valuable to them when doing future interventions in the Tugela Ferry community.

9.9.3 Assessment of serving system's impact on development

How do the systemic influences of the serving system on the system served, translate into an impact on socio-economic development?

In the social systems description of the serving system, it was indicated that the contribution of the ICT4D project on the mission system was mainly in terms of enhancing their authoritative resources, with the potential impact of enhancing allocative resources. Allocative resources could be enhanced as people's income earning capability was improved, whether in terms of their small businesses or in their capacity of trainers at the new local computer training centre. By enhancing the capabilities of the mission staff, not only to serve their specified clients but also to generate income and informally assist their neighbours, the IT training has assisted in strengthening the staff's own positions as well as that of the mission in service delivery. In the case of the medical centre, the mutually strengthening effect of the new skills of the nurses and the research capability of the medical centre has been indicated. As such, the mission system as a whole, and the mission institutions individually, have been assisted to better self-produce, to become more self-reliant and hence to become more sustainable.

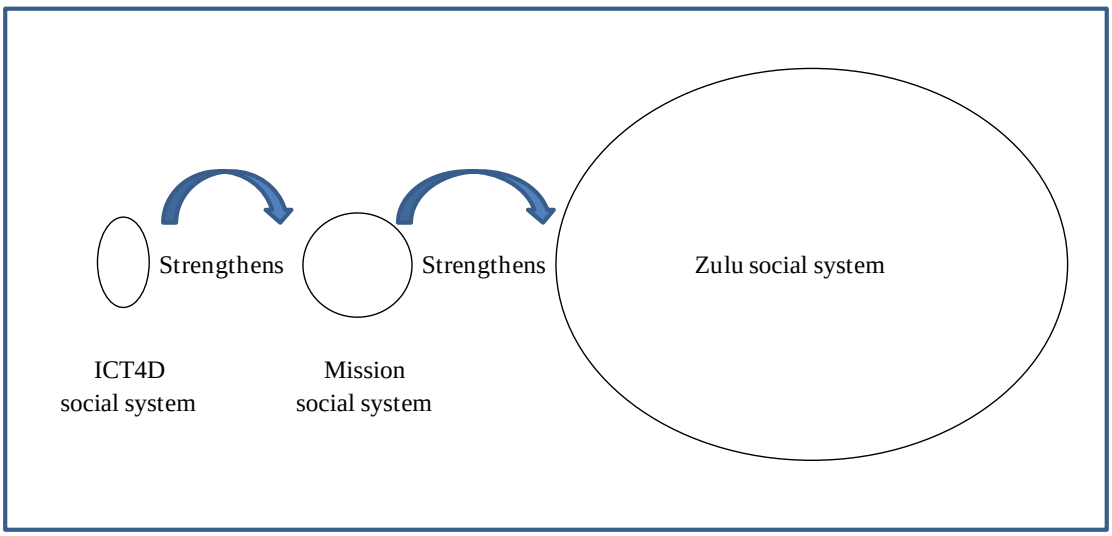

Figure 9.2: The strengthening influences among the social systems of interest

The mission system's contribution to the sustainability and socio-economic development of the Zulu social system has been described earlier. It can be argued that by the IT training's strengthening of the mission as a system, as shown in Figure 9.2 above, the mission's ability to serve the Zulu social system is enhanced. In particular, the local IT training centre established by mission members with the assistance of the ICT4D team, with the goal to train people from the broader Zulu community, is an example of potential socio-economic development.

9.10 Summary of findings

In this chapter, the social systems framework has been used to describe three social systems of interest in the ICT4D case study: the Zulu social system, the Christian mission and the ICT4D project as serving system. The same systems framework has been used to describe the mutual influences among the interacting systems. The study of the mutual influences of the social systems on each other, in particular the influence of the mission system on the traditional Zulu system, and the influence of the ICT4D serving system on the mission system directly, and the Zulu social system indirectly, has been used to indicate the serving system's impact on the self-production ability, self-reliance and hence sustainability of the systems served.

In each case where a serving system attempted to serve another system and managed to do it successfully (the mission serving the broader Zulu system, and the ICT4D project serving the

mission), it appears that the system was served in a particular manner. Firstly, the serving system managed to interface successfully with the system served. The equivalent autopoiesis term for interfacing is structural coupling. The serving system made an effort to understand the social structure of the system served namely their interpretive and normative rules, as well as authoritative resources. The serving system applied those same processes of social structuration when interacting with the system served, provided that the social structure was compatible with their own. For example, the mission worked along with the collectivist identity of the Zulus, as well as the Zulu value of caring, but not with their ancestral belief system. The ICT4D team acknowledged the authoritative resources of the mission. They utilised the collectivist social identity during training but not during course assessments. The interfacing or structural coupling was in each case so successful that the serving system to an extent became one with the system served, even though each system retained is own identity. For example, in the case of the mission it was stated earlier that the social "us" and "them" boundary of the past has diminished as Christian people became known for their willingness to help anyone in need (Respondent5). In the case of the ICT4D team, the headmistress at the mission started calling the ICT4D project leader "my son". As part of interfacing or structural coupling, the serving system also made an effort to recognise the social practices or rituals of the system served. Within the mission, the groups such as the youth or young couples gather in a way that recognise their collectivist identity, for example by singing together for long periods. The ICT4D team participated in the social practice of hospitality (Respondent10), both receiving hospitality and extending it back in Pretoria.

As a result of the successful structural coupling of the serving system and system served, the serving system could influence the system served to a large extent from 'within', since the serving system was perceived by the system served to have become part of it. The serving system could enhance the social structures of the systems served, in particular their allocative and authoritative resources, so that they could more effectively self-produce. The mission provided to its members alternatives to the Zulu normative rules that were perceived to be self-destructive, such as the male-female relationship, with one of mutual respect. The ICT4D team had a significant influence on the authoritative resource base of people active in mission institutions, such as the teachers and nurses, and thereby strengthening the institutions but also the institutions' ability to serve the broader community. Another way that the serving systems strengthened the systems served, was by mediating structural coupling between the system served and external institutions. For example, the mission facilitated interaction with government departments to help people from the Zulu community obtain birth certificates and subsequently, social welfare grants. They also assisted in the interfacing with the Department

of Justice to help orphans get placed with foster families. The ICT4D team facilitated the mission school's campus trip, helping to expose the Grade 11 learners to study and associated funding opportunities.

By assisting the systems served to more effectively self-produce their own social structures, and to structurally couple or interface with other service-providing institutions, the serving systems have assisted with socio-economic development, as defined in Chapter 2. According to autopoiesis theory, having contributed to the served systems' self-production and structural coupling imply that the systems served have become more sustainable.

9.10.1 Implications for future ICT4D projects

The systems descriptions focussed attention on some of the ways in which the serving systems managed to achieve their aims of strengthening the systems served. These insights can be applied when planning other socio-economic development initiatives. Some suggestions are distilled from the summary of findings above:

- Make an effort to understand the social structure of the system served, in terms of its interpretive and normative rules, as well as authoritative resources;
- Use this understanding to effectively interface and communicate with the system served, and in the process establish structural coupling;
- Having achieved structural coupling, try to influence the processes of social structuration of the systems served from within their own frames of reference;
- Acknowledge and leverage capabilities and resources within the systems served that can help to further strengthen them;
- Facilitate structural coupling between the system served and other social systems that may assist in strengthening the system served; and
- Identify destructive practices that continue to be reproduced in the system served, and find ways to counter these.

It is important to note that neither the mission nor the ICT4D serving systems achieved their aims by calculated or 'cold-blooded' approaches of effecting systemic influences. Their honest intention to make a difference and to respect the interests and existing social practices of the systems served were instrumental to their being accepted by the systems served.

9.11 Conclusion

This chapter has presented the analysis of the case study's empirical data. The analysis was done in the form of social systems descriptions, making use of the social systems framework in Table 9.1. A systematic application of the concepts of the systems framework was used to provide rich descriptions of the individual social systems, followed by descriptions of their mutual influences, with particular focus on the influence of each serving system on its system(s) served. The ICT4D project's contribution to the socio-economic development of both the mission and wider Zulu social system could accordingly be assessed. It was shown how the serving systems' assisting of the systems served to more effectively self-produce their own social structures, and to structurally couple or interface with other service-providing institutions, have assisted in their socio-economic development.

Chapter 10 Conclusion

10.1 Introduction

After having addressed all the derived research questions in previous chapters, this chapter will consider the main research question, to see whether the study has contributed to the following:

- How can social systems theory help us to describe and assess the contribution of an IT intervention on the social system it serves, in a remote, rural African community?

Before doing this, a general summary and reflection on the research is provided. The research is assessed in various manners, including an assessment of the research process using Klein and Myers' (1999) principles for interpretive field studies, and an assessment of the theoretical contribution against the criteria suggested by Whetten (1989). The researcher also provides her own reflection on challenges experienced and considers opportunities for future research.

10.2 Summary of research: problem, planning and execution

10.2.1 Revisiting the problem

The problem stated in Chapter 1 was the difficulty of demonstrating an ICT4D project's contribution to 'development', meaning the sustainable socio-economic development of the larger social system within which an ICT intervention is made. 'Development's definition was taken to be self-reliant human-scale development that includes interdependence with other social systems. This definition also assisted in dealing with the associated problematic notion of 'sustainability', which in ICT4D literature was found to be largely focused on the sustainability of the ICT intervention itself. It was argued that an ICT4D project should aim to contribute to the sustainability, or self-reliance, of the containing social system.

To address the challenge of demonstrating a project's contribution to development, it was argued that a systems approach be followed. One of the key properties of systems thinking is its ability to relate the parts to the whole. A systems approach would provide a means to describe the interconnections or influences between different aspects of a system, in order to investigate how changes or additions to the system will affect the overall system. As such, it

would provide a language to help assess the effect of an ICT4D intervention to the containing system, in which ever way the containing system is defined.

10.2.2 A possible systems framework

It was further argued that the containing system should be investigated with a social systems approach, acknowledging its social as well as systemic nature. A journey to search for an appropriate systems approach led to the development of selection criteria as well as the identification of an interesting and promising approach. The approach entailed a conceptualisation of social autopoiesis, utilising structuration theory. This conceptualisation met the selection criteria specified for a social systems approach, and in addition indicated a way to describe a system particularly in terms of sustainability and interdependence with other systems, thus linking with the definition of development. As such, the social autopoiesis conceptualisation was selected and further developed into a systems framework for empirical application.

10.2.3 Empirical research

Empirical research was undertaken in the form of a single, longitudinal, interpretive case study in the rural village of Tugela Ferry in KwaZulu Natal, South Africa. IT literacy training was performed by a team from the University of Pretoria from 2009 - 2011. The community in which training took place was defined for purposes of analysis as two systems served: a mission system and a larger Zulu social system. These two systems were studied and described by means of the social systems framework. The ICT4D project was described as the serving system. The systems descriptions were used to investigate the mutual influences of the systems on each other, which could accordingly be used to assess the influence of the ICT4D system on its systems served.

10.3 Assessment of research undertaken

Assessment of the research is performed below in a number of ways. Firstly, the incremental contributions of the study are listed. Secondly, the research process is evaluated against Klein and Myers' (1999) criteria for conducting interpretive research. Thirdly, the theoretical contribution is assessed by using Whetten's (1989) criteria. Lastly, the research includes an own assessment of challenges experienced during the research process and with the theoretical framework.

10.3.1 Incremental contributions of this study

This study contributed the following incremental elements, each containing a small element of novelty. The combination of the small contributions adds up to the overall contribution of the study:

- Arguing for the use of systems thinking in ICT4D, to assess the contribution of an ICT4D project to the socio-economic development of the system(s) it serves (Chapter 2);
- Performing an assessment of the current literature concerned with systems thinking in ICT4D (Chapter 2);
- Traversing the literature on systems thinking as well as social theory in search of social systems theories or approaches to describe the social context of an ICT4D project (Chapters 4 and 5);
- Suggesting criteria for selecting such a social systems approach (Chapter 5);
- Investigating the applicability of social autopoiesis as a social systems approach in the context of the case study (Chapter 6);
- Developing the existing conceptual ideas around integrating structuration theory and autopoiesis, into a systems framework for practical application on the ICT4D case study (Chapter 7);
- Application of the systems framework to an ICT4D case study in rural KwaZulu Natal, South Africa (Chapters 8 and 9), resulting in a series of systems descriptions and influences; and
- Indicating how the social systems descriptions could be used to assess the contribution of the ICT4D serving system to the socio-economic development of the mission and Zulu systems served (Chapter 9).

The overall contribution can accordingly be summarised as the development and application of a social systems framework to assess the contribution to socio-economic development of an ICT4D project on the social system(s) served by it.

10.3.2 Assessment of conducting an interpretive field study

The empirical process is assessed using Klein and Myers' (1999) principles for doing interpretive field research. These principles are applicable to case study as well as ethnographic research (Myers, 2009:84). Please refer to Section 3.4.5 for a summary and

explanation of the seven principles, which were provided as part of the study's research planning and accordingly used as a guide for conducting empirical research. The application of these principles is described and assessed below.

10.3.2.1 The principle of the hermeneutic circle

Field work for the case study was performed during a total of five visits to the case study setting over a period of two and a half years. The repeated practice of being immersed in the details of the community during a field trip, and time away from the community between visits, allowed for a hermeneutic process. During periods away from the community, the researcher reflected on the theoretical framework, the data collected as well as personal experiences in the field. These reflections, together with continual further reading back at home, informed the development of the theoretical framework as well as the planning for each subsequent field trip. In short, a hermeneutic process underpinned and integrated all aspects of the study.

10.3.2.2 The principle of contextualisation

In Chapter 8, a demographic analysis was done for the Msinga community, which represented the general research setting. For each social system of interest, namely the two systems served and the serving system, historical as well as general contextual information was provided. As such, the principle of contextualisation was thoroughly applied as preparation for the field study.

10.3.2.3 The principle of interaction between researcher and subjects

The researcher's subjectivity led her to often experience and classify the Zulu culture as different to her own culture and the mission culture as similar to her own. The mission people accepted the researcher as one of them, feeling free to give her an insider's view and even sharing self-criticism of the mission culture. When interacting with Zulu people, whether members of the mission church or not, the researcher's interaction with males was very different to the interaction with Zulu females. The females were spontaneous and willing to volunteer information of a personal nature. Males were much more formal in their interaction. Regarding the researcher's view of the traditional Zulu culture being 'different': she almost missed a comment by a research participant that the Zulu community is traumatised by the fast pace of change that they are exposed to. Whereas the rural Zulu community appears to be much 'behind' in development compared to the researcher's own urban environment, a person

living in the Zulu community had to point out that they are also experiencing a rapid process of development. On the IT literacy training course, the researcher, when conversing with trainees, was always addressed with the respect assigned to a teacher. Trainees were without exception positive about the IT training they received, and may have omitted their negative experiences so as not to offend the researcher. The examples discussed above are evidence of the researcher's awareness of her own subjective position and its influence during interaction with participants.

10.3.2.4 The principle of abstraction and generalisation

Modelling assumptions and simplifications are presented in Chapter 8. These have been informed by jointly reflecting on the contextual information related to the research setting, the theory studied and the empirical situation. The social context of the ICT4D project is defined and modelled as social systems of interest. In Chapter 9, the systems framework is used as the theory by which to describe the social systems. Abstraction, as part of a reflective process, played a central role in how data was collected and interpreted in the study.

10.3.2.5 The principle of dialogical reasoning

The dialogical reasoning is between the way the theory guides the researcher to see the situation and the story that the data tells. The researcher's first exposure to the case setting led to a strong impression that the identities of the traditional Zulu culture and the mission culture were well defined and self-producing. These impressions influenced the choice of theory, which again led the researcher to observe the situation in a particular manner. With subsequent data collection exercises, it appeared that the researcher's first impressions on the community had to be altered. The Zulu community was clearly not economically self-producing, something that the structuration based theory with its overly social focus was weak in pointing out. The researcher realised she had to be more careful in applying the theory, which had a strong influence since it was used for both data collection and analysis. This is evidence of critical awareness of the theory used and its limitations.

10.3.2.6 The principle of multiple interpretations

It did not frequently happen that multiple versions or interpretations of the same situation were found. One example was the differences in interpreting the national and local government's approach towards the tribal leadership system. While an official from local government saw some changes as essential to socio-economic development in the community,

a number of people believed that changes to tribal leadership was eroding the basis of Zulu culture. It was also experienced that when people started to trust the researcher, they more freely expressed their views, to the point of being critical of their own social systems.

Thus, since the case environment was not highly politicised and this was not a critical study, not many conflicting interpretations were found. However, deeper trust relationships led to people revealing other interpretations than the superficial.

10.3.2.7 The principle of suspicion

The researcher was always the guest of the mission when visiting Tugela Ferry. Most of the study's information was collected from members from the mission church. The mission members were not only more accessible because she stayed among them; they were also able to speak English in contrast to most traditional Zulu people. In order to prevent a view that was overly biased from the mission's point of view, the researcher made an effort to also collect data from people not belonging to the mission church, even though this was harder to achieve. As such, the principle of suspicion played a limited role in the study.

10.3.2.8 Reflection on applying the principles

Under the headings above, clear evidence was provided of the application of Klein and Myers' (1999) principles while conducting research. The principle of the hermeneutic circle was central to all aspects of the study, including not only the empirical research but also the research planning and the development of the theoretical framework.

10.3.3 Assessment of theoretical contribution

Whetten's (1989) criteria for evaluating a theoretical contribution are used to assess the contribution of the study at theoretical level. The application of Whetten's (ibid) criteria will simultaneously serve as a way to assess the social systems framework, which has been motivated by means of the researcher's own set of criteria before applying it, and which needs to be assessed again after its empirical application.

Whetten (ibid) guides the researcher in describing the theory in terms of four building blocks it needs to contain: the "what", "how", "why" and "who/where/when" of the theory. The "what" refers to the building blocks of the theory, whether they are called elements, concepts or variables. "How" refers to the relationships between the building blocks. The "what" and

"how" together *describe* the theory. The "why" *explains* or motivates why the particular set of factors have been put together as they are – why have they been selected and why should someone use the theory? The "who/where/when" considers the limitations of the theory – under what conditions is it applicable?

The theoretical framework of this study has been described in detail in Chapter 7, and is summarised in Table 7.1. In this way, the "how" and "what" elements have been addressed. The question of "why" has been discussed at different levels throughout the thesis. In Chapter 2, the "why" of using systems thinking to assess the contribution of ICT4D to development is discussed. In Chapter 5, the theory is motivated at a high level using a set of criteria for selecting a social systems framework. Chapter 6 addresses some aspects related to the "why" of social autopoiesis. Chapter 7 motivates for the particular systems framework elements at a more detailed level.

The who/where/when of the particular case study for which the systems framework has been developed, is presented in Chapter 8. Chapter 3 discusses the limitations of the study in terms of the ability to generalise from the case. However, the limitations of the theory itself need to be considered separately. The core of the theoretical framework consists of two theories: structuration theory and autopoiesis. Structuration theory is a general social theory that could be applied, conceptually or empirically, in any social setting. Autopoiesis has not been developed for application in a social setting. Therefore, a large portion of Chapter 6 is dedicated to the theoretical applicability of autopoiesis in the social domain. Having concluded in Chapter 6 that autopoiesis can indeed be applied in principle to a social context, without having to prove that the system under consideration is autopoietic or organisationally closed, the question remains: in what social settings? The researcher believes that the theory's applicability then moves to concerns of ease of use and usefulness. The social systems in Tugela Ferry provided a relatively easy setting to apply autopoiesis to, because the social systems had distinct social characteristics (organisation) and were socially relatively isolated, thus easy to 'model'. Mingers (1995:205) holds as criteria for the acceptability of social autopoiesis its effectiveness and usefulness. The usefulness of the theory can be assessed by the outcome of its application, which is discussed in Chapter 9.

After having described and motivated the theoretical framework and its applicability, the focus moves to Whetten's (1989) seven questions of assessing the *value* of the theory presented. The seven questions are as follows:

i. *What's new?* What is the value-added contribution to current thinking? The degree of "differentness" is more important than the scope of the contribution.
ii. *So what?* Will the contribution be able to influence research practice, and are practically feasible solutions proposed to address current gaps?
iii. *Why so?* Is the underlying reasoning credible, in terms of the train of logic, quality of argumentation and making visible of assumptions?
iv. *Well done?* Does the work reflect thoroughness, completeness and seasoned thinking?
v. *Done well?* Is the thesis well written, with its central ideas being accessible?
vi. *Why now?* Is the work addressing current concerns and topical issues?
vii. *Who cares?* Is the work of interest to a big enough academic audience?

Responses to Whetten's (ibid.) questions are presented below:

10.3.3.1 What's new?

What are the aspects of novelty of this study? Firstly, the use of systems thinking to assess the contribution of an ICT4D project on the socio-economic development of the encompassing system has not been done in this manner before. In Chapter 2, the researcher indicates the overall lack of systems thinking in ICT4D, and also the lack of systems approaches in ICT4D impact assessment frameworks.

Second, by using the systems framework of social autopoiesis in the above context, the researcher has theoretically linked the autopoiesis concepts of autonomy (or being self-sustaining) and structural coupling with 'developmental' concepts in the ICT4D domain, namely self-reliance, mutual interfacing (Roode et al., 2004), and sustainability.

A third aspect of novelty is that the combined structuration theory/ social autopoiesis concept has been developed into a framework that can be applied empirically for data collection and analysis.

10.3.3.2 So what?

The resources and effort spent on ICT4D are only justified if they have an impact on socio-economic development. In particular, the contribution of ICT4D to the wider social system where it is deployed needs to be shown. Such contribution is very difficult to demonstrate, and this study suggests a new means to do this. In particular, the research shows that the problem is a systems problem, and then suggests a systems approach to deal with it.

The systems framework developed towards this end has been applied to an ICT4D case study to show its practical value. Since the field of ICT4D is theoretically very fragmented, with a wide range of theory being used on case studies, it is not evident that an ICT4D audience will be convinced to apply it in practice, even if they recognise the theoretical value. The fact that the theory has been used on only one case study is a limitation, although it is at the same time an opportunity for further empirical research.

10.3.3.3 Why so?

What makes this research contribution credible? Research has been systematically guided by the research questions that were formulated. The reasoning followed was made as clear as possible, substantiating claims by means of existing work, empirical evidence and/or a transparent train of logic. Assumptions have been surfaced and made explicit throughout the study; whether these were the assumptions about development and ICT4D (discussed in Chapter 2), assumptions related to systems thinking (discussed in Chapter 4), assumptions underlying the research philosophy (discussed in Chapter 3), assumptions about the nature of the system studied (discussed in Chapter 5), or modelling assumptions (discussed in Chapter 8).

10.3.3.4 Well done?

To assess whether the study contains seasoned thinking, completeness and thoroughness, and whether its ideas have matured over time, the researcher can claim the application of the principle of the hermeneutic circle in all aspects of the study, as motivated earlier against Klein and Myers' (1999) principles. For example, throughout the case study, the theory has informed data collection which again informed the theory. Periods of reflection and study were alternated with periods of involvement with ICT4D team members, periods of exchanging ideas with colleagues/experts/supervisors, and periods in the field, all which informed each other. Also in the spirit of interpretive research, an attempt was made to get broad and multiple perspectives on the theoretical bases available, and to similarly collect multiple perspectives, including a historical perspective, as part of the empirical study. The researcher can, by observing how her own ideas have developed since the first research paper on the topic (Turpin, 2009) show evidence of growth in thinking.

10.3.3.5 Done well?

To assess whether the thesis is well written and accessible, an overview is given of how it is presented. The study has been carefully set out to commence with a literature-based motivation of the problem statement. A theoretical framework using systems thinking is developed by first scrutinising existing systems as well as social theories to search for social systems approaches that could be applied to study ICT4D's social context. During the search, criteria are identified for selecting a social systems theory. Also during the search, the researcher has identified the theory of social autopoiesis as her personal preference, and she has justified the choice of theory against the stated criteria. The main building blocks of the theory, namely structuration theory and autopoiesis, are subsequently discussed in more detail to gain a firm insight into their central tenets. Since the social application of autopoiesis is controversial, the researcher conducts her own investigation into its applicability to the social domain, and to the case study in particular. After having gained a thorough understanding of the theoretical elements, the researcher develops a social systems framework from the theoretical principles. The framework is accordingly used to collect and analyse data on an ICT4D case study. Data analysis takes the form of a systems description and analysis. The result of the data analysis is the ability to respond to the stated problem of assessing the contribution of ICT4D to development, in the context of the case study.

It is acknowledged that the theory of autopoiesis is not readily accessible: Bailey (1994) claims that the major hindrance that has kept autopoiesis from being used more widely is the inaccessible writing style of its primary authors. The researcher makes an effort to provide an accessible overview, but there may remain members of the ICT4D or IS audience who find that they do not readily engage with it. The researcher has however noted that some of her IS colleagues are wary of the theory because of its biological origins and perceptions that it is functionalist. These concerns have been discussed at length, from the research philosophy assumptions in Chapter 3 all the way to the modelling assumptions in Chapter 8. In this manner, the theory has been "opened up" to the reader.

10.3.3.6 Why now?

The topic of socio-economic development is a matter of urgency in South Africa, as many poverty-stricken citizens feel increasingly left out of the development they were anticipating after 1994. Also, while the study's focus on a deeply rural tribal system may seem antiquated, this system is a daily reality to millions of people, not only in KwaZulu Natal but in many other remote African settings. ICT4D practitioners and researchers alike are compelled to

consider the actual developmental impact of their activities. Walsham's (2005) passionate plea for the IS community to seriously engage with concerns of socio-economic development still holds, and it reverberates in Heeks' (2010) call for investigating the downstream impact of ICT4D projects.

10.3.3.7 Who cares?

An ICT4D audience that is concerned with effecting socio-economic development would find this work relevant. Secondly, a systems audience who is interested in the value obtained from applying systems thinking in a social context would constitute an audience. The researchers specifically concerned with applying autopoiesis socially constitute a relatively small audience. However, the ICT4D and systems audience are wider audiences.

10.3.4 Own assessment of challenges faced

In the assessment that follows, the researcher critiques and assesses her approach.

The researcher possibly made the research project difficult by attempting a number of challenging activities: Searching and motivating for a social systems approach (which entailed a broad search through different subject disciplines as well as developing a set of selection criteria), applying Mingers' concepts in practice (which meant justifying the use of social autopoiesis as well as operationalising Mingers' concepts), applying a theory from outside the ICT4D domain (which meant motivating for it), and having to revisit Giddens to use as part of a social autopoiesis framework, in a different way than usually applied in IS (which meant a thorough study of structuration theory and having to motivate for a different application).

The difficulty of addressing multiple audiences, simultaneously trying to make a contribution to an ICT4D audience and the systems fraternity, was experienced. The researcher had a personal interest in systems thinking, and the application domain of the thesis was ICT4D.

The researcher has elected to use a theoretical framework that is different and possibly controversial, thereby making successful research dissemination more of a challenge. The level of conceptual difficulty of the chosen theory, in particular the autopoiesis part, may hinder the wider adoption of the theory, even though its benefits for ICT4D are well argued. Further, the controversy around using a systems theory whose distinguishing elements are biologically based may pose another barrier to adoption.

Despite all the challenges experienced, it was an immensely exciting intellectual journey during which a new and different social systems approach was developed to apply in ICT4D. The field trips to the rural Zulu community was personally rewarding at a level that cannot compare with research in an urban context. The researcher had an opportunity to learn from people who were materially poor but socially and spiritually wealthy. She further had the privilege to be involved in a project where the difference that it made could be personally observed, and not just theoretically argued.

10.4 Opportunities for further research

The biggest current limitation of the social systems framework is that it was developed with a particular case setting in mind, meaning that there is not yet empirical evidence for its wider applicability. The framework now needs to be tested in another rural, developing country ICT4D context, to see whether similar value can be added and insights be gained. Perhaps, the framework needs to be tested in a situation where an ICT4D intervention failed, to see if it could provide explanations based on a description of the social systems served, using the framework concepts. An investigation could also be made as to the framework's applicability to other complex societal systems, perhaps outside the ICT4D context.

Other possibilities include revisiting the framework to include recent contributions on socio-economic development, such as Sen's capability approach (Zheng 2009), where Sen's notion of 'capability' bears interesting resemblances with Giddens' (1984) notion of 'capability' in a social structuration context.

One of the shortcomings of Giddens' structuration theory is its assumption that everything that affect humans can be described by considering the social. A challenge faced with the existing social systems framework was to try and describe purely economic activity. In fact, some economic concerns of the systems served were almost missed when using the Giddens lens. Fuchs (2010) notes the same concern regarding social theory. This matter can be investigated to see if the systems framework can be revisited to better address the noted concern.

When using Giddens' structuration theory to assess a project's contribution to socio-economic development, it only accounts for contributions that can be described in terms of structural rules and resources. It was clear that the mission social system as well as the ICT4D project made a contribution to the communities they served in terms of unselfish practical caring,

which can be associated with ubuntu. While this caring often resulted in benefits that could be described in terms of, for example, allocative resources, the act of caring itself as a valued social contribution did not fit in the Giddens-based theoretical framework. While Giddens' social theory cannot be expected to be all-encompassing, the recognition of ubuntu related practices can be investigated as a topic for further research.

An area for further research that was suggested by an external examiner, was to further explore the autopoietic notion of consensual domains that form through structural coupling. In this study, the ICT4D social system pro-actively worked to strengthen effective communication and social relations with the mission as their system served. The mission in turn managed to develop a good social rapport with the larger Zulu system. The establishment of consensual domains is implied in the data as a success factor facilitating socio-economic development, while it was not explicitly included in the theoretical framework. Further work on applying autopoiesis concepts in ICT4D will benefit from including this notion.

10.5 Final remarks, and revisiting the main research question

This chapter provided a summary of the research undertaken. The research process as well as its contribution was assessed in multiple ways. This study's research results, presented in Chapter 9, indicate the value of systems thinking that is carefully applied to a complex problem situation. In particular, it provides an example of the potential contribution of systems thinking to ICT4D, after having indicated its severe lack in Chapter 2. In line with the systems theme of the thesis, Checkland and Holwell's (1998) definition of an information system was used throughout. The notions of 'system served' and 'serving system' provided a suitable frame of reference with which to respectively model the social context of the ICT4D project and the ICT4D project itself. The description of the serving system and its systems served by means of the social systems framework made it possible to assess the mutual influences among these systems, and in particular the influence of the serving system on the systems served. In this way, the contribution to development of an ICT4D project to the systems served in a remote, rural African community could be assessed.

The main research question was accordingly addressed:

- How can social systems theory help us to describe and assess the contribution of an IT intervention on the social system it serves, in a remote, rural African community?

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